

AGRICULTURAL
ECONOMICS
RESEARCH UNIT



Lincoln College

LOCATION OF FARM ADVISORY
OFFICERS IN NEW ZEALAND
AN APPLICATION OF FACILITY
LOCATION ANALYSIS

by

JOAN R. RODGERS
OWEN McCARTHY
&
VICKI MABIN

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THE AGRICULTURAL ECONOMICS RESEARCH UNIT

THE UNIT was established in 1962 at Lincoln College, University of Canterbury. Its major sources of funding have been annual grants from the Department of Scientific and Industrial Research and the College. These grants have been supplemented by others from commercial and other organisations for specific research projects within New Zealand and overseas.

The Unit has on hand a programme of research in the fields of agricultural economics and management, including production, marketing and policy, resource economics, and the economics of location and transportation. The results of these research studies are published as Research Reports as projects are completed. In addition, technical papers, discussion papers and reprints of papers published or delivered elsewhere are available on request. For list of previous publications see inside back cover.

The Unit and the Department of Agricultural Economics and Marketing and the Department of Farm Management and Rural Valuation maintain a close working relationship in research and associated matters. The combined academic staff of the Departments is around 25.

The Unit also sponsors periodic conferences and seminars on appropriate topics, sometimes in conjunction with other organisations.

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P R E F A C E

Previous Unit studies in the facility location series have been concerned with locating processing plants, specifically wool stores and meat freezing works.

The present study uses essentially the same methodology to investigate another type of facility location problem, namely the location of service personnel.

The personnel involved are farm advisory officers of the Ministry of Agriculture and Fisheries. The problem was considered a particularly appropriate one for Unit research and in any case our links with the Ministry ensured that data were collected with tolerance and only a little amusement.

Be perfectly clear however that our solutions should not be used to berate the Ministry regarding existing locations of farm advisory officers. In characteristic academic style we assumed away the problem of locating all other Ministry personnel and focussed only on farm advisory officers. Had we not done so the solutions could have been markedly different.

Owen McCarthy
Director

October 1975

CONTENTS

	Page
1. INTRODUCTION	1
2. DESCRIPTION OF THE SYSTEM AND DEFINITION OF THE PROBLEM	3
2.1 The System of Providing Farm Advisory Services	3
2.2 The Nature of the Problem	7
2.3 Investigation of Policy Alternatives	11
3. THE MODEL AND THE SOLUTION TECHNIQUE	13
3.1 The Transshipment Model	13
3.2 Complications to the Transshipment Model	19
3.3 Algebraic Statement of the Problem	26
3.4 The Solution Technique	29
3.5 Refinement of Solutions using Linear Programming	36
4. RESULTS	43
4.1 Low Cost Solutions	43
4.2 Evaluation of Policy Alternatives	51
4.3 Summary and Conclusions	54

REFERENCES

- APPENDIX A - Possible Office Locations
- APPENDIX B - Final Destination Regions
- APPENDIX C - Scale Curves
- APPENDIX D - Cost of Travel Data
- APPENDIX E - The M.A.F.'s Plan and Three
Low Cost Solutions
- APPENDIX F - Solutions Under Policy
Alternatives

1. INTRODUCTION

This paper deals with a problem of facility location. The nature of the general facility location problem and a method of solution, based on the transportation algorithm and heuristic procedures, have been discussed in previous reports published by the Agricultural Economics Research Unit (4), (1). This study is concerned with the problem of providing farm advisory services to New Zealand farmers. Its aim is to determine a number of acceptable sets of locations for farm advisory officers, who are employed by the Ministry of Agriculture and Fisheries to service farmers. In doing so the facilities which are to be spatially located are the offices from which the advisors operate. The location plans produced by this research apply to the year 1977¹.

The paper is divided into three sections. Firstly the system of providing farm advisory services is described and the problem of locating farm advisory officers throughout the country is defined in detail. Then follows an explanation of the model which was used to represent the system and of the methodology which was applied to the model in order to solve the problem.

¹ The computer program used to perform the analysis was written by John Rodgers.

We are grateful to Messrs Cameron, Reynolds and Anderson and others of the Advisory Services Division for their co-operation in supplying the data on which this study is based.

Finally, the results produced by the solution technique are presented and are evaluated by comparing them with a plan put forward by the Ministry of Agriculture and Fisheries. In addition, the study incorporated the examination of a number of policy alternatives. These are also discussed.

2. DESCRIPTION OF THE SYSTEM AND DEFINITION OF THE PROBLEM

2.1 The System of Providing Farm Advisory Services

Farm advisory services are provided to New Zealand farmers by officers of the Advisory Services Division of the Ministry of Agriculture and Fisheries. In order to administer the activities of the division the country is partitioned into eight regions. These in turn are divided into subregions, although subregional boundaries have changed frequently in the past. Each region has a regional headquarters, one or more subregional offices and usually a number of branch offices. In all there are currently 50 towns throughout New Zealand from which farm advisory officers operate. Current office sites, regional and subregional boundaries are shown in Figure 2.1. Each farm advisory officer provides a consultative service to farmers living in proximity to the office at which he is located. However, the transversal of regional boundaries in providing this service is prohibited.

The Advisory Services Division is one of nine divisions within the Ministry of Agriculture and Fisheries and farm advisory officers make up about 50% of current (and projected) staff numbers for that division, (see Table 2.1). The Advisory Services Division also employs a number of horticultural advisory officers and other farm advisory officers who carry out specialist activities.

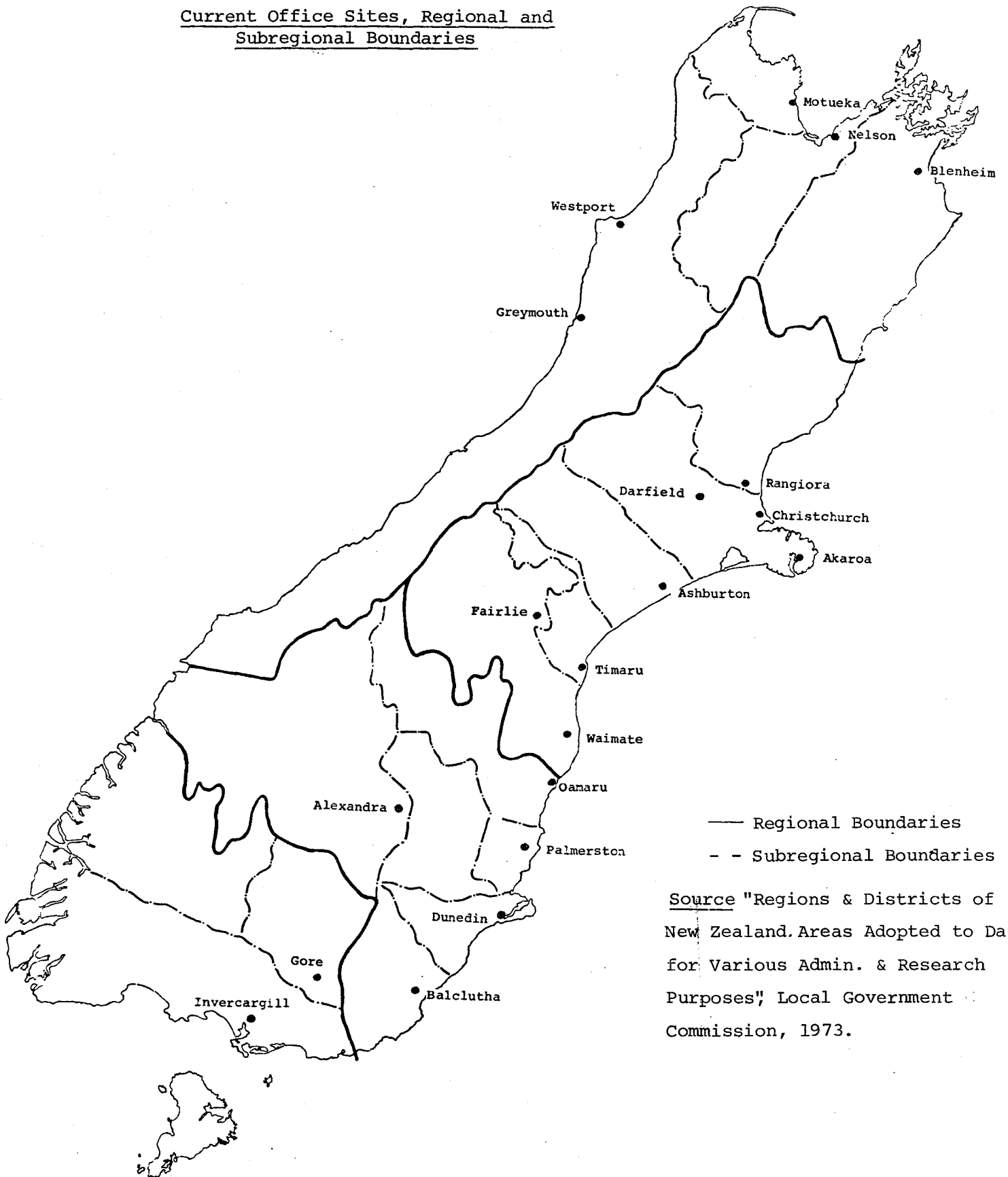
Figure 2.1

Current Office Sites, Regional and Subregional Boundaries



Figure 2.1 (cont'd)

Current Office Sites, Regional and Subregional Boundaries



— Regional Boundaries
- - Subregional Boundaries

Source "Regions & Districts of New Zealand. Areas Adopted to Date for Various Admin. & Research Purposes", Local Government Commission, 1973.

TABLE 2.1

Composition of the Advisory Services Division

	<u>Employed,</u> <u>Dec, 1974</u>	<u>Projected</u> <u>Staffing, 1977</u>
Farm Advisory Officers	139 (57.5%)	185 (53.8%)
Horticultural Advisory Officers	40 (16.5%)	53 (15.4%)
Farm Advisory Officers (Agric. Engn., including 4 Civil Engineers)	26 (10.7%)	26 (7.6%)
Farm Advisory Officers (Economics)	7 (2.9%)	26 (7.6%)
Farm Advisory Officers (Animal Husbandry)	9 (3.7%)	26 (7.6%)
Farm Advisory Officers (Poultry)	10 (4.1%)	18 (5.2%)
Farm Advisory Officers (Seeds)	6 (2.5%)	5 (1.4%)
Other Specialist Advisors	5 (2.1%)	5 (1.4%)
TOTAL	242	344

Note: This table does not include Regional Advisory Officers, head office staff or staff on extended leave without pay.

Source: Ministry of Agriculture and Fisheries.

Although the location of these people does not fall within the scope of this study there are two points to note:

- (a) farm advisory officers comprise only a small section of all Ministry staff, and
- (b) it is necessary to take into account any dependence between the farm advisory officers and other Ministry personnel, particularly those of the Advisory Services Division, with whom they work most closely.

2.2 The Nature of the Problem

The problem is that of locating the 185 farm advisory officers who will be employed by the Ministry of Agriculture and Fisheries in 1977. Specifically, we wish to establish:

- (a) the number and location of offices from which these men should operate,
- (b) the number of farm advisory officers attached to each office, and
- (c) the area to be serviced by each farm advisory officer at each office.

The optimal solution to the problem is defined as that which minimizes the total cost of providing farm advisory services and, at the same time, satisfies certain criteria which have been specified by the

Ministry of Agriculture and Fisheries.

The total cost of providing farm advisory services has two components; travel costs and office costs.

Travel Costs: The function of the farm advisory officer is to provide general information to farmers and this information is usually provided on the farm. The common mode of operation is for the farm advisory officer to leave his office in the morning, visit one or more farms during the course of the day and return to his office in the afternoon. Travel costs from office to farm(s) and back again therefore form one part of the overall cost of providing this service to farmers.

Office Costs: The second cost component is that of running the offices at which farm advisory officers are located. Here economies of scale are expected to be found since farm advisory officers can share certain facilities such as office space, typing services, and so on. However, at certain offices the sharing of facilities also takes place between the farm advisory officers and other Ministry staff, particularly those of the Advisory Services Division, who share the same premises. It is necessary, therefore, to identify those office costs which are directly attributable to the farm advisory officers.

In summary, the total cost of providing farm advisory services is the aggregate of travel costs and office costs. If the system is centralised with a small number of large offices, then travel costs tend to be high compared to those of a less centralised system, which has a large number of small offices. On the other hand, the existence of economies of scale implies that a more centralised system has lower office costs per unit than a less centralised system. Therefore, it is probable that the minimisation of total costs will involve a tradeoff between the cost of travel and the cost of running the offices at which the men are stationed. However, if office costs per unit are not monotonically decreasing, the nature of low cost solutions is less predictable.

The Ministry has listed four restrictions which must be satisfied in minimising total costs:

Restriction 1:

Farm advisory officers should not be located in towns which cannot provide adequate facilities for a satisfactory lifestyle for himself, his wife and family. For example, the provision of secondary school facilities is mandatory.

Restriction 2:

An adequate level of service should be provided to all farmers who seek it. The method used to measure an "adequate level of service" is discussed in Section 3.

Restriction 3:

The number of farm advisory officers employed in providing this service should equal the total number available in 1977.

Restriction 4:

Farm advisory officers should not be forced to travel excessive distances in order to provide their service to farmers. The definition of an "excessive distance" varies to some extent throughout the country, depending upon the terrain and the intensity of farming carried out in a particular area. However, for the country as a whole, a figure in excess of 30,000 kilometers per annum would be considered excessive.

For problems of the type considered here, an optimal solution is not strictly necessary. Rather, the provision of a number of solutions, each of which is of acceptably low cost and adheres to the constraints specified above, is considered to be a more useful alternative for decision making purposes. However, each solution should be better than one based on

intelligent guess work, so some means of comparison is required. To this end, the Ministry was asked to provide its planned allocation of farm advisory officers for 1977 and this was used as a basis against which solutions were evaluated.

2.3 Investigation of Policy Alternatives

In addition to providing a number of satisfactory solutions to the problem, certain policy alternatives were also examined:

Policy 1:

The fact that regional boundaries cannot be crossed in providing farm advisory services to farmers has already been mentioned. The position of regional boundaries effects the total cost of operating the system since farmers within a given region cannot be serviced by farm advisory officers operating from towns outside that region. An investigation was carried out to determine whether it would be advantageous to alter current regional boundaries.

Policy 2:

The Ministry has shown some interest in moving farm advisory officers out of the regional headquarters (that is, Auckland, Hamilton, Hastings, Palmerston North, Nelson, Christchurch, Dunedin and Invercargill).

The implications of providing farm advisory services from a set of offices, excluding those above were examined.

Policy 3:

Some Ministry personnel feel that one man offices are undesirable because of the lack of contact of men stationed at these offices with their colleagues elsewhere. The effect of forcing all offices to a size of at least two men was investigated.

Policy 4:

Finally, solutions were produced in which the set of office locations was restricted to those in the Ministry's plan to determine whether a reallocation of men between offices would result in a better plan than that of the Ministry.

The results of these investigations are presented in Section 4 of this paper.

3. THE MODEL AND THE SOLUTION TECHNIQUE

The system of providing farm advisory services can be formulated as a transshipment model, although in doing so a few complications arise.

3.1 The Transshipment Model

In a transshipment context the problem is viewed as one of allocating farm advisory officers from a supply source to intermediate facility points and then to final destination regions where their services are demanded, (see Figure 3.1). Total costs are minimised and the four restrictions discussed in Section 2,2 are satisfied in the manner described below.

The supply source is a pool containing the total number of farm advisory officers who will be employed by the Ministry of Agriculture and Fisheries in 1977. This was taken to be their projected staffing for 1977 of 185 men. (Restriction 3).

Intermediate facility points consist of the set of possible office locations. In consultation with Ministry personnel, a list of offices was compiled containing the 50 existing office sites and thirty three potential locations, all of which are considered to possess the necessary attributes for a satisfactory life-style as specified in restriction 1. (These locations are listed in Appendix A and are shown in Figure 3.2).

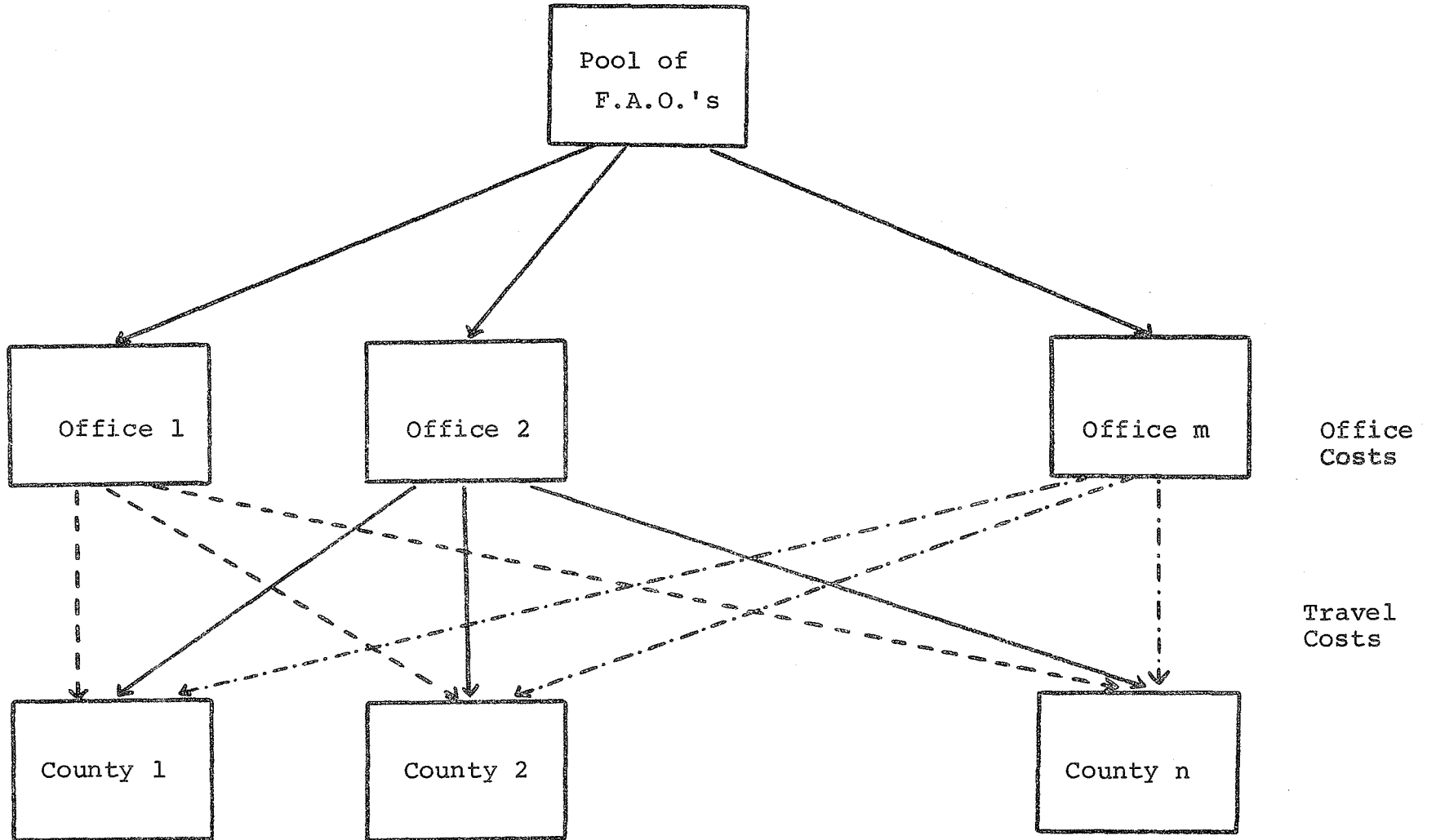
Figure 3.1

Spatial Representation of the Transshipment Model

Supply Source

Intermediate
Facility Points

Final
Destination
Regions



Office
Costs

Travel
Costs

Figure 3.2
Potential Office Sites



Figure 3.2 (cont'd)

Potential Office Sites



Counties are used to represent final destination regions because of the availability of statistical data on a county basis. Large counties, which are difficult to service, were split into two final destination regions while other small counties were combined to form one final destination region. This produced a set of final destination regions which are more homogeneous in terms of size and also helped in collecting the necessary data for estimating the parameters of the model.

In compliance with restriction 2, farmers in each county demand (and must receive) an adequate level of service. In defining this term there are two aspects to consider : the quantity of service provided and the quality of service provided.

The quantity of service is measured by the number of farm visits demanded by, and supplied to each county annually. Furthermore, farm advisory services should be equitably distributed throughout New Zealand so the number of farm visits received annually by each county is taken to be a constant percentage of the total number of agricultural holdings per county. (A list of counties and the estimated number of agricultural holdings in each, appears as Appendix B). It is assumed here that farmers will accept as many visits as can be provided, so demand is set at the highest possible level without exceeding the supply constraint of 185 men.

This is equivalent to an annual service rate of 90% of agricultural holdings per county.² However, a general model is presented in this paper which has been constructed in such a way that the percentage of farmers serviced annually may be set at any level less than or equal to 90%. Therefore it can be used also in situations where the assumption of insatiable demand does not apply.

The quality of service is related to the professional expertise of the farm advisory officer and to the quantity of service provided. Since all farm advisory officers receive sufficient training to enable them to carry out their duties efficiently, only the latter need be considered here. Given that each farm advisory officer is working to capacity, the greater the number of farm visits provided annually to a given county, the more brief and presumably the less thorough each visit must be. This inverse relationship between quantity and quality is taken into account by assuming that all visits provided are of sufficient duration to ensure a satisfactory service in terms of quality. The effect of this assumption is a conservative estimate of the number of visits which can be provided annually to a given county by one man operating from a given office.

² This may be interpreted to mean that 90% of farmers in each county receive one visit per annum, or 45% of farmers receive two visits per annum, and so on.

Under these conditions a 90% service rate is considered to be adequate.

Finally the costs associated with the transshipment model must be considered. Zero costs are incurred in allocating farm advisory officers from the supply source to each intermediate facility point. Office costs are associated with each intermediate facility point and travel costs are incurred in providing visits from each intermediate facility point to each final destination region. Servicing possibilities which require excessive distances to be travelled are excluded from the solution by setting their costs of travel at prohibitively high levels, thus satisfying restriction 4.

3.2 Complications to the Transshipment Model

There are a number of complications which must be overcome in formulating the problem in a transshipment context.

Firstly, office costs per farm advisory officer are not constant because of the existence of economies of scale. This problem has been encountered in previous applications in the area of facility location and can be overcome by constructing a scale curve³ for each office location.

³ The nature of the scale curve is discussed by McCarthy et.al. (4).

Heuristic methods for solving transshipment problems of this kind have been devised by Logan and King (2), (3) and more recently by Stammer (6). In this application, however, it was necessary to allow for the presence of other Ministry staff in constructing the scale curves for certain offices. In the main, any interoccupational sharing of office facilities takes place between the farm advisory officers and other members of the Advisory Services Division but since the latter carry out work which is largely specialist in nature, there is little flexibility in determining where they should be located. It was assumed, therefore, that those members of the Ministry who share office facilities with the farm advisory officers will remain at their current office locations in 1977. The additional long term costs of attaching a given number of farm advisory officers to these offices were estimated and used in constructing a scale curve for each office.⁴ The "lumpy" nature of certain office costs results in scale curves which are discontinuous. For example if one typist is required for an office containing six or fewer men, typing costs per men will decline over this range.

⁴ Only those office costs per man which vary either with office size or with office location are included in these calculations.

However an office with seven men will require two typists so an increase in typing costs per man will occur at this point. The irregular shape of the scale curves makes it difficult to predict the nature of low cost solutions. (Appendix C lists the cost factors included in the construction of scale curves and the final equations derived.)

In the model depicted in Figure 3.1 supply and demand are measured in different units; supply is measured in terms of men and demand is measured in terms of visits. A transformation either of supply from men into visits or of demand from visits into men, is required but is complicated by the fact that the number of visits which one man can supply annually to a given county depends upon the office at which he is located. For example, one man stationed at Ashburton can supply 454 visits per annum to Ashburton county but only 324 visits per annum to Ellesmere county. It is simpler to convert demand than supply since a transformation on the latter would require scale curves for each office to be expressed on a per visit, rather than on a per man, basis. Therefore, the transformation is performed on demand. The initial conversion of demand from visits into men is based on the assumption that visits are supplied from the nearest office, in the sense of being the office from which the largest number of visits can be supplied annually.

For example, consider the following table of hypothetical data showing the number of visits required annually by three counties and the number of visits which can be provided to them annually by one man operating from one of two offices.

Table 3.1

Matrix of Visits

	County 1	County 2	County 3
Office 1	250	150	200
Office 2	200	225	300
Demand	500	450	400

Demand for county 1 would be converted from visits into men on the assumption that visits are supplied from office 1, since it can provide more visits per annum than office 2. The number of men required to supply 500 visits per annum to county 1 from office 1 is two. Similarly, office 2 would be assumed to provide the 450 visits to county 2 using two men. County 3 may be serviced by either office since both require two men to provide 400 visits.⁵

5

A non integer allocation of men is not permitted by the solution technique.

The final complication is concerned with balancing the problem. In doing so it is necessary to ensure that:

- (a) all 185 farm advisory officers are fully utilised. That is, the model should be constructed in such a way that it is impossible for any farm advisory officer to be employed in servicing only dummy (that is, non-existent) counties, and
- (b) each county receives an adequate level of service as defined previously, that is, the model should be constructed in such a way that the required level of service cannot be supplied by a dummy (that is, non-existent) supply.

The problem in matrix form is depicted in Figure 3.3. For generality a dummy supply is introduced and demand for each county is split into two parts; essential demand (which corresponds to the adequate level of service) and excess demand. Note that essential demand cannot be supplied by the dummy supply⁶ while excess demand can be supplied by either the effective supply of 185 men or from the dummy supply.

⁶ If demand by each county is not split in this way there is the possibility that demand by counties where travel costs are high would be met entirely by the dummy supply, that is, would not be met at all.

Figure 3.3

Matrix Representation of the Transshipment Model

	OFFICE 1	OFFICE 2		OFFICE m	COUNTY 1	COUNTY 2		COUNTY n			
Supply	O_1	O_2		O_m	∞	∞	∞	∞	∞	S_1	
Dummy Supply	0	0		0	∞	0	∞	0	∞	S_2	
	0	∞		∞	t_{11}	t'_{11}	t_{12}	t'_{12}	t_{1n}	t'_{1n}	K_1
	∞	0			t_{21}	t'_{21}	t_{22}	t'_{22}	t_{1n}	t'_{2n}	K_2
Demand	K_1	K_2		K_m	D_1	D_1	D_2	D_2	D_n	D_n	K_m
	∞	∞		0	t_{m1}	t'_{m1}	t_{m2}	t'_{m2}	t_{mn}	t'_{mn}	

Travel costs incurred in providing essential visits in Figure 3.3 are expressed on a per man, per annum, basis. (The number of visits which one man, operating from each office listed in Appendix A can supply annually to various counties in Appendix B are listed in Appendix D. Appendix D also gives the annual cost of travel and the number of kilometers, required in travel, to supply these visits.) The annual travel costs of supplying excess visits may be set at either of two levels:

- (a) The annual cost of supplying excess visits to a given county from a given office may be set at the annual cost of supplying essential visits to the same county from the same office. This implies that each farm advisory officer works at full capacity and farmers will accept as many visits as can be provided. All counties therefore receive the required number of essential visits (that is, the number required to provide one visit per annum to a given percentage of agricultural holdings in each county) but some counties may receive additional visits.
- (b) Alternatively, the cost of supplying excess visits may be set at zero. The implication here is that farm advisory officers work at

less than full capacity because farmers will not accept visits beyond a certain level. In this case, farm advisory officers providing excess visits in any solution to the problem will share the workload of those farm advisory officers providing essential visits from the same office to the same county. For example, if each of the three men located at office i can supply 150 visits per annum to county j and if two of these men supply essential visits while the other supplies excess visits, then county j will receive 300 visits per annum, 100 from each of the three men.

Since it is assumed here that farmers' demand for visits is insatiable, the first alternative is adopted and the level of essential demand to be met annually is set at 90% of agricultural holdings per county.

3.3 Algebraic Statement of the Problem

The problem depicted in matrix form in Figure 3.3 can now be stated in algebraic notation.

Minimise:

$$Z = \sum_{i=1}^m (f_i(x_i)x_i) + \sum_{i=1}^m \sum_{j=1}^{2n} t_{ij} \hat{x}_{ij}$$

where:

Z is total cost

m is the number of possible office locations

n is the number of counties (therefore $2n$ is the number of final destinations)

x_i is the number of farm advisory officers at office i

$O_i = f_i(x_i)$ is the office cost per farm advisory officer at office i and it is a function of the number of farm advisory officers at office i . Therefore

$\sum_{i=1}^m O_i x_i = \sum_{i=1}^m (f_i(x_i) x_i)$ is the total office costs.

t_{ij} is cost of travel from office i to destination j per farm advisory officer per annum

\hat{x}_{ij} is the number of farm advisory officers supplying visits to destination j from office i . Therefore

$\sum_{i=1}^m \sum_{j=1}^{2n} t_{ij} \hat{x}_{ij}$ is total travel costs.

Subject to:

$$(1) \quad \sum_{i=1}^m x_i = S_1 \quad (\text{supply constraint})$$

where:

S_1 is the supply of farm advisory officers

$$(2) \quad \sum_{k=1}^n x_{2k}^* = S_2 \quad (\text{supply constraint})$$

where:

x_{2k}^* is the number of farm advisory officers servicing region $2k$ from the dummy supply.

S_2 is the dummy supply for farm advisory officers.

$$(3) \quad x_i \leq K_i \quad i=1, 2, \dots, m \quad (\text{capacity constraint})$$

where:

K_i is the transshipment constant for office i and is interpreted as the maximum number of farm advisory officers who can be located at each office

$$(4) \quad x_i = \sum_{j=1}^{2n} \hat{x}_{ij} \quad i=1, 2, \dots, m \quad (\text{input/output constraint})$$

$$(5) \quad \sum_{i=1}^m \hat{x}_i'_{2k-1} = D_{2k-1} \quad k=1, 2, \dots, n \quad (\text{demand constraint})$$

where:

D_{2k-1} is demand for farm advisory officers in region $2k-1$, that is, essential demand

$$(6) \quad x_{2k}^* + \sum_{i=1}^m \hat{x}_{i,2k} = D_{2k} \quad k=1, 2, \dots, n \quad (\text{demand constraint})$$

where:

D_{2k} is demand for farm advisory officers in region $2k$, that is, excess demand

$$(7) \quad \sum_{t=1}^2 S_t = \sum_{j=1}^{2n} D_j \quad \text{and}$$

for feasibility

$$\sum_{k=1}^n D_{2k-1} \leq S_1$$

$$(8) \quad D_{2k-1} = f(v_{2k-1}, | i, \hat{x}_{i,2k-1}; i=1, 2, \dots, m)$$

$$k=1, 2, \dots, n$$

where:

v_{2k-1} is demand for visits in region $2k-1$, that is, essential demand.

(This is the transformation of essential demand from men into visits).

3.4 The Solution Technique

The methodology applied to the model described above is based on a combination of the transportation algorithm and the heuristic search procedure devised by

Stammer for handling the nonconstant per unit costs associated with each office location. Also included is the initial transformation of demand by each county from visits into farm advisory officers who will supply those visits and subsequent reconversions of each solution from men into visits. (A flowchart, setting out the various steps in the solution technique appears as Figure 3.4). The methodology is now described in detail.

Step 1:

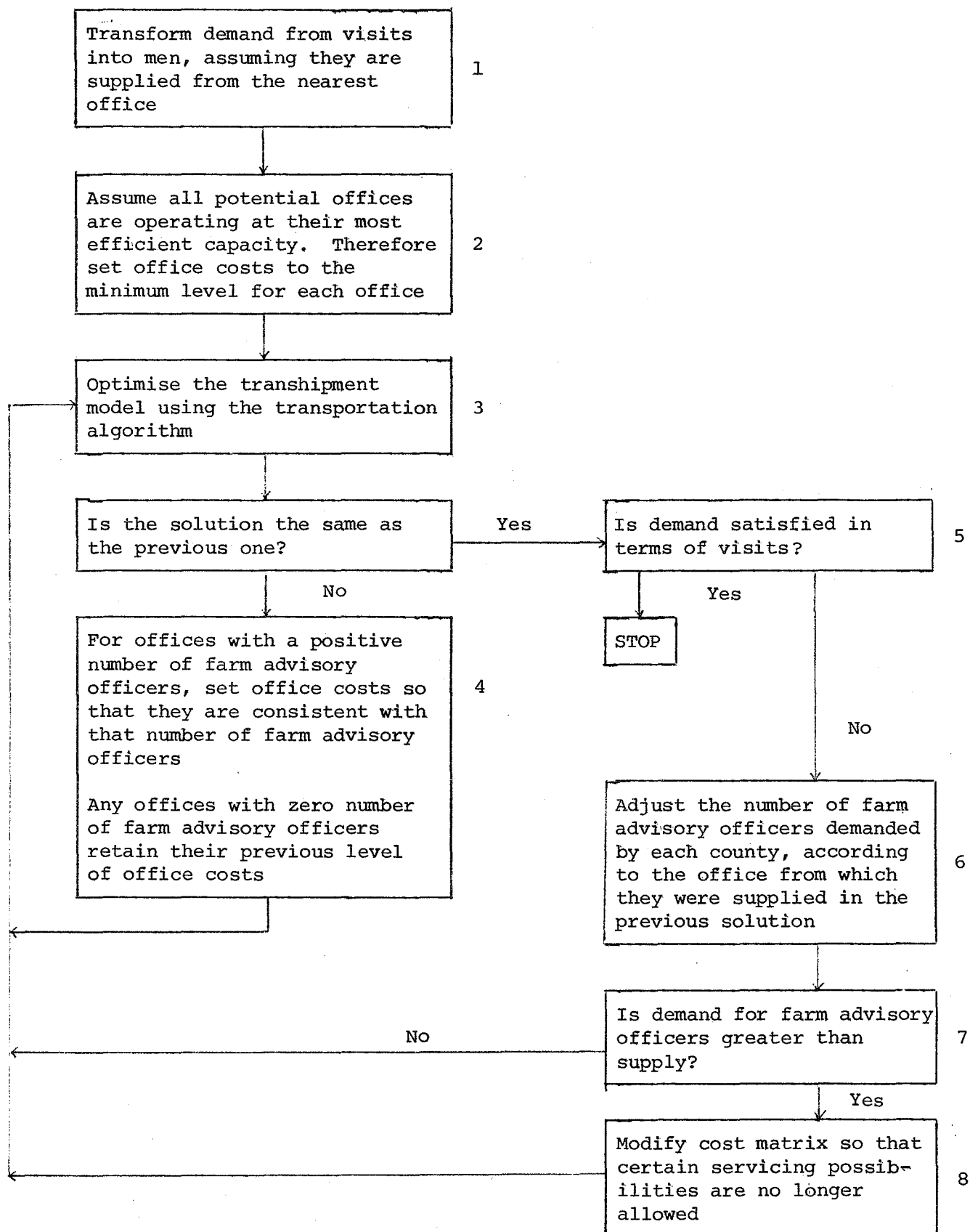
At the beginning of each run essential demand by each county is transformed from visits into men on the assumption that farm advisory officers service each county from the nearest office. The resulting total demand for farm advisory officers must be less than or equal to the supply of 185 farm advisory officers available. Excess demand may be set at any level since the presence of a dummy supply will allow the problem to be balanced. Here the number of men required to service 100% of agricultural holdings per county annually (from the nearest office) was used to represent excess demand.

Step 2:

Initial office costs are set at zero level which makes all offices competitive as far as office costs are concerned.

Figure 3.4

Flow Chart of Solution Technique



Step 3:

The transportation algorithm is then invoked and a solution is produced.

Step 4:

The solution is examined to determine the number of farm advisory officers allocated to each office, and average office costs are set at the corresponding level. Offices to which no men have been allocated, retain their previous per unit office costs.

Another solution is then produced using the transportation algorithm and average office costs are adjusted again. This process continues until there is no change in the solution.

Steps 5 and 6:

When a stable solution is produced the number of men servicing each county from each office in the solution is retransformed into visits to determine the number of essential visits supplied to each county.

$$V'_j = \sum_{i=1}^m v_{ij} \hat{x}_{ij} \quad j=1,2, \dots, n \quad (1)$$

where:

V'_j is the total number of essential visits supplied to county j in the solution.

v_{ij} is the number of visits which can be

supplied annually to county j by one farm advisory officer operating from office i .

\hat{x}_{ij} is the number of farm advisory officers servicing county j from office i in the current solution.

If this number is greater than or equal to the number of essential visits demanded by each county, then the procedure terminates. If not, demand in terms of farm advisory officers is adjusted upwards according to the offices from which men are supplied in the current solution, using the equation.

$$D_j^+ = (D_j \times V_j) / V'_j \quad j=1,2, \dots, n \quad (2)$$

where:

D_j^+ is the updated essential demand for farm advisory officers by county j .
 D_j^+ is an integer value, equal to or greater than that derived from equation (2).

D_j is the essential demand for farm advisory officers in county j , in the problem just solved.

V_j is the essential demand for farm visits in county j .

V'_j is the number of essential farm visits actually supplied, as calculated in equation (1) above.

To illustrate this procedure the matrix of visits presented in Table 3.1 is repeated in Table 3.2. Suppose a solution is produced as in Table 3.3 with four men at office 1 and two men at office 2.

Table 3.2

Matrix of Visits

	County 1	County 2	County 3	
Office 1	250	150	200	
Office 2	200	225	300	
Demand	500	450	400	(visits)
Demand	2	2	2	(men)

Table 3.3

Solution

	County 1	County 2	County 3	
Office 1	2	2		
Office 2			2	
Demand (Adjusted)	2	3	2	(men)

Two men operating from office 1 can supply only 300 visits to county 2, so demand for essential visits is not satisfied. Three men are required to supply 450 visits to county 2 from office 1 so demand by county 2 is adjusted to three men.

Steps 7 and 8:

It is possible that such a transformation will result in a demand for farm advisory officers providing essential visits which exceeds supply. In the example above, this would occur if only six farm advisory officers were available. Should this occur, transport costs of servicing possibilities which lead to this result are set at prohibitively high levels. In our example in Tables 3.2 and 3.3, office 1 would be prohibited from servicing county 2 in this way.

Average office costs are left at their previous level and the transportation algorithm is applied to find a new solution. This double iterative procedure from step 3 to step 8 is repeated until a stable solution is produced in which each county receives the required number of essential visits.

The procedure described above produces a local minimum but solutions of lower cost may exist. If one (or more) office enters the solution during the first iteration at a level where per unit office costs are high and consequently is dropped from the solution in

the second and successive iterations, then the final solution may be of higher cost than other solutions containing this office.

A method which can be used to search for better solutions is known as the "forcing technique". This technique has been discussed elsewhere (5) but basically in entails an artificial manipulation of per unit office costs in order to encourage certain offices into a solution and/or to force other offices out of a solution. When applied to the model presented here, the forcing technique produced a number of solutions which have lower costs than those of the original solution found.

3.5 Refinement of Solutions using Linear Programming

Solutions produced by the transportation algorithm and heuristic procedures described in Section 3.4 are entirely integer in nature. For example, if two farm advisory officers are allocated to office i, which can serve county j and county k, then there are three possible solutions:

- (a) two men service county j from office i
(which implies that county k is serviced from another office)
- (b) one man services county j and one man services county k, or
- (c) both men service county k (county j being serviced from another office).

The methodology will not allow, for example, 1.5 men to service county j and 0.5 to service county k from office i. Such a solution would be interpreted to mean that one man spends 100% of his time servicing county j while the other spends 50% of his time servicing county j and 50% of his time servicing county k. An allocation pattern of this kind may well result in a better solution in terms of cost minimisation.

In order to allow farm advisory officers the option of allocating their time between counties, the solutions produced by the transportation-heuristic procedure were given the opportunity of being modified using linear programming. The linear programming matrix used to refine the solution in this way appears in Figure 3.5 and an algebraic statement of the problem follows:

Minimise:

$$Z = \sum_{i=1}^m O_i x_i + \sum_{i=1}^m \sum_{j=1}^n t_{ij} \hat{x}_{ij} + M.D.^*$$

where:

Z is total cost,

O_i is the average office cost per farm advisory officer at the i^{th} office,

x_i is the number of farm advisory officers operating from the i^{th} office,

t_{ij} is the cost of travel from office i to county j,

Figure 3.5

Linear Programming Matrix

OFFICE 1	OFFICE 2	.	.	.	.	OFFICE m	COUNTY 1/ Office 1	COUNTY 2/ Office 1	.	.	.	COUNTY 1/ Office m	COUNTY 2/ Office m	COUNTY n/ Office m	D	D*		
O_1	O_2	.	.	.	.	O_m	t_{11}	t_{12}	.	.	.	t_{m1}	t_{m2}	t_{mn}		M		obj. fn
+1	+1	.	.	.	.	+1											$= C_1$ $= C_2$	no. of men at each office
-1						-1	+1	+1			+1						$= 0$	distribution of men from offices to counties
												+1	+1		+1		$= 0$	
							v_{11}					v_{m1}			$-d_1$		≥ 0	constraints of no. of visits provided to each county
								v_{12}					v_{m2}	$-d_2$		≥ 0		
										v_{1n}				v_{mn}	$-d_n$		≥ 0	
															+1	+1	$= 2$	

\hat{x}_{ij} is the number of farm advisory officers servicing county j from office i ,

m is the number of possible office locations

n is the number of counties,

M is a very large number, and

D^* is a dummy activity.

Subject to:

$$(1) \quad x_i = C_i \quad i = 1, 2, \dots, m$$

where:

C_i is the number of farm advisory officers allocated to office i in the solution to the transshipment problem, i.e. the number of men at each office is predetermined and so per unit office costs are known.

$$(2) \quad \sum_{j=1}^n \hat{x}_{ij} = x_i \quad i = 1, 2, \dots, m$$

(these rows allocate farm advisory officers from offices to counties and since the activities are not integer, the sharing of time between counties is permitted).

$$(3) \quad \sum_{i=1}^m v_{ij} \hat{x}_{ij} \geq d_j D \quad j = 1, 2, \dots, n$$

where:

v_{ij} is the number of visits which can be provided annually to county j by one man operating from office i ,

d_j is the number of agricultural holdings in county j , and

D is the proportion of agricultural holdings per county serviced annually.

$$(4) \quad D + D^* = 2$$

where:

D^* is a dummy activity which will be as small as possible, since its objective function coefficient is very large. As a result D will be as large as possible, that is, the level of service provided to farmers will be as high as possible.

The following two examples illustrate the types of refinements in solutions which may occur.

Example 1

One solution obtained from the transshipment model allocated four farm advisory officers to the Rangiora office with one man servicing each of Waipara, Ashley, Oxford and Rangiora counties. The linear programming

solution allocated the four men to the same counties but in different proportions (see Table 3.4).

Table 3.4
Servicing of Counties from Rangiora

	Transshipment Model	Linear Programming Model
Waipara	1	0.8
Ashley	1	0.6
Oxford	1	0.4
Rangiora	1	2,2

Example 2

The counties serviced by a given office in the transshipment model may be changed in the linear programming solution, as occurred in a solution where two men were stationed at Westport and one man was located at each of Greymouth and Hokitika (see Table 3.5).

Table 3.5
Servicing of Counties from Westport,
Greymouth and Hokitika

	<u>Transshipment Model</u>		
	Westport	Greymouth	Hokitika
Buller	1		
Inangahua	1		
Grey		1	
Westland			1

Linear Programming Model

	Westport	Greymouth	Hokitika
Buller	1.7		
Inangahua	0.3		
Grey		1.0	0.1
Westland			0.9

4. RESULTS

4.1 Low Cost Solutions

A number of solutions to the transshipment model were produced using the transshipment algorithm, heuristics and the forcing technique.⁷ Many of these solutions do not differ markedly, in terms of total cost, from the best solution produced. Therefore, three low cost solutions, which provide some variety in terms of the number, size and location of offices, were refined using the linear programming model and are presented in this report.⁸ (Full details of these solutions appear in Appendix E).

The tentative allocation pattern for 1977, provided by the Ministry of Agriculture and Fisheries was used to evaluate the results of the study. Since the Ministry's plan specifies the number of farm advisory officers to be stationed at the various office sites but does not indicate which counties are to be serviced from each office, the linear programming model was used to determine the least-cost method of servicing counties, given the number of men at each office in the plan, (see also Appendix E).

⁷ Each of these solutions is a local minimum, but there is no way of knowing whether or not the global minimum has been obtained. However, as was explained in Section 2.2, an optimal solution to the problem is not necessary.

⁸ Each solution is divided into its North and South Island components so effectively six alternative solutions are available.

Should the Ministry decide upon a distribution of farm advisory officers from offices to counties which differs from the linear programming solution then the cost of the plan will increase. The evaluation of the three solutions presented here therefore can be regarded as conservative.

Comparisons between the Ministry's plan and the three low cost solutions can be made by referring to Tables 4.1 and 4.2. All three solutions are of lower cost than the Ministry's plan; solution 1 resulting in a saving of \$43,770 per annum or 13.7%, solution 2 resulting in a saving of \$37,178 per annum or 11.6% and solution 3 resulting in a saving of \$16,178 per annum or 5.0% compared to the Ministry's plan. The greatest savings occur in office costs, particularly in the North Island. At first glance this may seem strange since Table 4.2 reveals that solutions 1, 2 and 3 are less centralised than the Ministry's plan. However, it is explained by the irregular shape of the scale curves associated with each office location and by the relative distribution of farm advisory officers between the North and South Islands.

In addition to having lower costs, each of the three solutions results in a higher level of service to farmers compared to the Ministry's plan. Recall that the level of service is measured by the percentage of agricultural holdings per county which receive one

Table 4.1

Low Cost Solutions

	<u>M.A.F.'s</u> <u>Plan (\$)</u>	<u>Solution 1</u> <u>(\$)</u>	<u>Solution 2</u> <u>(\$)</u>	<u>Solution 3</u> <u>(\$)</u>
<u>North Island</u>				
Office costs	93,301	59,175	64,061	82,658
Travel costs	101,336	109,239	107,026	104,585
Total costs	194,637	168,414	171,087	187,243
No. of F.A.O.'s	114	121	121	121
<u>South Island</u>				
Office costs	43,851	34,214	38,129	39,870
Travel costs	82,121	74,211	74,215	77,318
Total costs	125,972	108,425	112,344	117,188
No. of F.A.O.'s	71	64	64	64
<u>New Zealand</u>				
Office costs	137,152	93,389	102,190	122,528
Travel costs	183,457	183,450	181,241	181,903
Total costs	320,609	276,839	283,431	304,431
Savings		43,770 (13.7%)	37,178 (11.6%)	16,178 (5.0%)
No. of F.A.O.'s	185	185	185	185
Modal service level	50%	90%	90%	90%
Mean service level	126.5%	130.8%	130.8%	135.0%
Standard deviation	122%	65%	67%	75%

NB Office costs refer only to those costs which are a function of office size and/or office location.

Table 4.2

Number of F.A.O.'s Located at Offices

Office Location	M.A.F.'s Plan	Solution 1	Solution 2	Solution 3
<u>Region 1</u>				
Auckland	4	4	4	4
Whangarei	4	6	4	4
Dargaville	4	2	2	2
Kaikohe	3	2	2	4
Kaitaia	2	2	2	2
Pukekohe	5	6	6	4
Warkworth	3		2	2
Kerikeri		1	1	1
Helensville		2		2
Maungaturato		2	2	
	<u>25</u>	<u>27</u>	<u>25</u>	<u>25</u>
<u>Region 2</u>				
Hamilton	6	6	6	6
Rotorua	4	2	2	2
Te Kuiti	4	4	4	4
Matamata	3		2	5
Morrinsville	3	9	7	5
Taumarunui	3	2	2	2
Taupo	2	1	1	1
Tauranga	4	5	5	4
Te Awamutu	3	2	2	2
Thames	3	2	2	4
Whakatane	3	2	2	2
Opotiki		1	1	1
Huntly		2	2	2
Te Kauwhata			2	
	<u>38</u>	<u>38</u>	<u>40</u>	<u>40</u>
<u>Region 3</u>				
Hastings	7	5	5	4
Gisborne	5	5	3	3
Dannevirke	4	1		4
Masterton	5	7	8	7
Ruatoria	2	1	1	1
Wairoa	3	1	1	1
Pahiatua		2	2	2
Waipukurau		2	2	2
Tolaga Bay			2	2
	<u>26</u>	<u>24</u>	<u>24</u>	<u>26</u>
<u>Region 4</u>				
Palmerston North	8	11	11	9
New Plymouth	6	9	9	7
Wanganui	4	3	5	5
Hawera	5	1	1	5
Levin	2	1		
Taihape		2	2	2
Wellington			1	1
Marton		2		
Stratford		2	2	
Feilding		1	1	1
	<u>25</u>	<u>32</u>	<u>32</u>	<u>30</u>

Table 4.2 cont'd

Number of F.A.O.'s Located at Offices

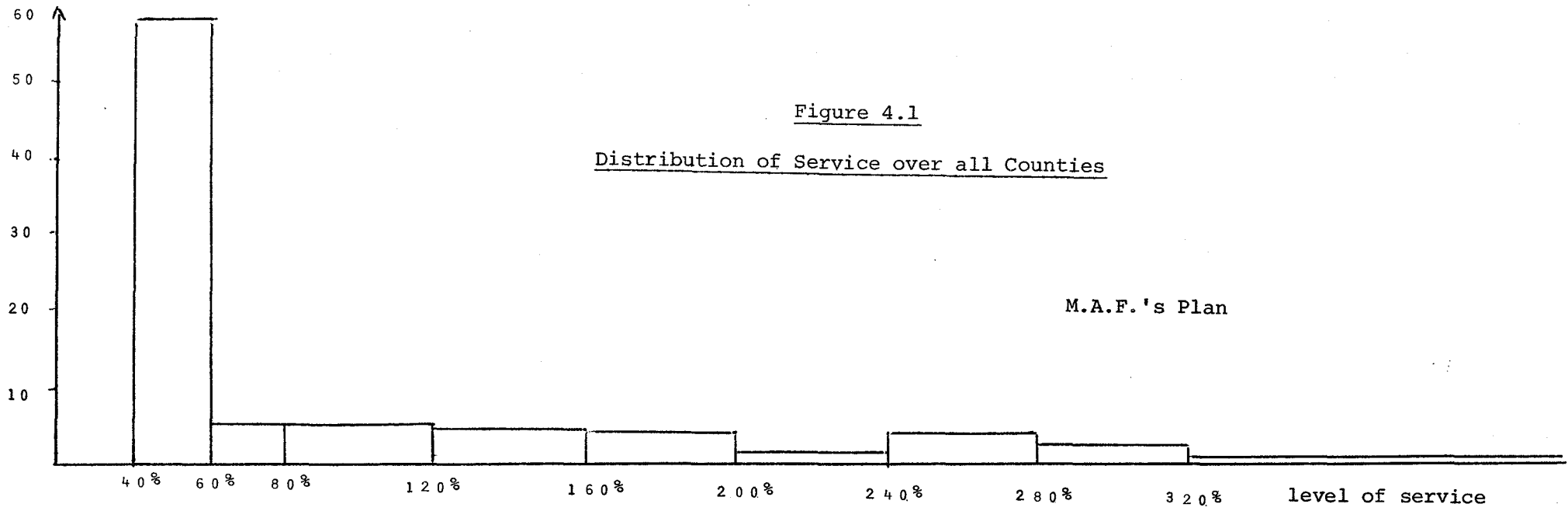
Office Location	M.A.F.'s Plan	Solution 1	Solution 2	Solution 3
<u>Region 5</u>				
Nelson	3	4	4	4
Blenheim	4	3	3	4
Greymouth	2	1	2	1
Motueka	2			
Westport	2	2	2	2
Kaikoura		1	1	
Hokitika		1		1
Takaka		1	1	1
	<u>13</u>	<u>13</u>	<u>13</u>	<u>13</u>
<u>Region 6</u>				
Christchurch	6	1	1	4
Rangiora	6	4	3	5
Ashburton	5	5	5	3
Timaru	6	3	3	3
Akaroa	1	2	2	1
Fairlie	2	1	1	1
Waimate	2	1	2	2
Darfield		1	1	1
Leeston		2	2	
St. Andrews		2	1	
Cheviot		1	1	1
Culverden		1	2	2
	<u>28</u>	<u>24</u>	<u>24</u>	<u>23</u>
<u>Region 7</u>				
Dunedin	3	3	3	3
Oamaru	4			3
Alexandra	4	3	3	1
Balcultha	4	1	3	5
Palmerston	1	1	1	1
Queenstown		1	1	1
Ranfurly		1	1	1
Kurow		2	2	
	<u>16</u>	<u>12</u>	<u>14</u>	<u>15</u>
<u>Region 8</u>				
Invercargill	8	7	7	8
Gore	6	5	3	3
Te Anau		1	1	
Otautau		2	2	2
	<u>14</u>	<u>15</u>	<u>13</u>	<u>13</u>

farm visit per annum. Three statistics are used to compare the level of service in each of the four solutions in Table 4.1. These are the modal (or most frequently received) level of service, the mean (or arithmetic average) service level and the standard deviation of the service level.

In the Ministry's plan, most counties receive a 50% level of service (the mode). That is, in the majority of counties 50% of farmers receive one visit per annum, or 25% of farmers receive two visits per annum and so on. However, in each of the three low cost solutions, most counties receive a 90% service level (the mode). That is, in the majority of counties 90% of farmers receive one visit per annum, or 45% of farmers receive two visits per annum and so on.

In each of the four solutions some counties receive a level of service which is higher than the modal level. This results in a distribution of service over all counties which is highly skewed to the right (see Figure 4.1). A few counties in each of the four solutions receive a very high level of service and hence the mean (or arithmetic average) service level is larger than the mode. Under these conditions the modal service level is the more appropriate statistic since it is more representative of the level of service received by the vast majority of counties.

no. of counties



no. of counties

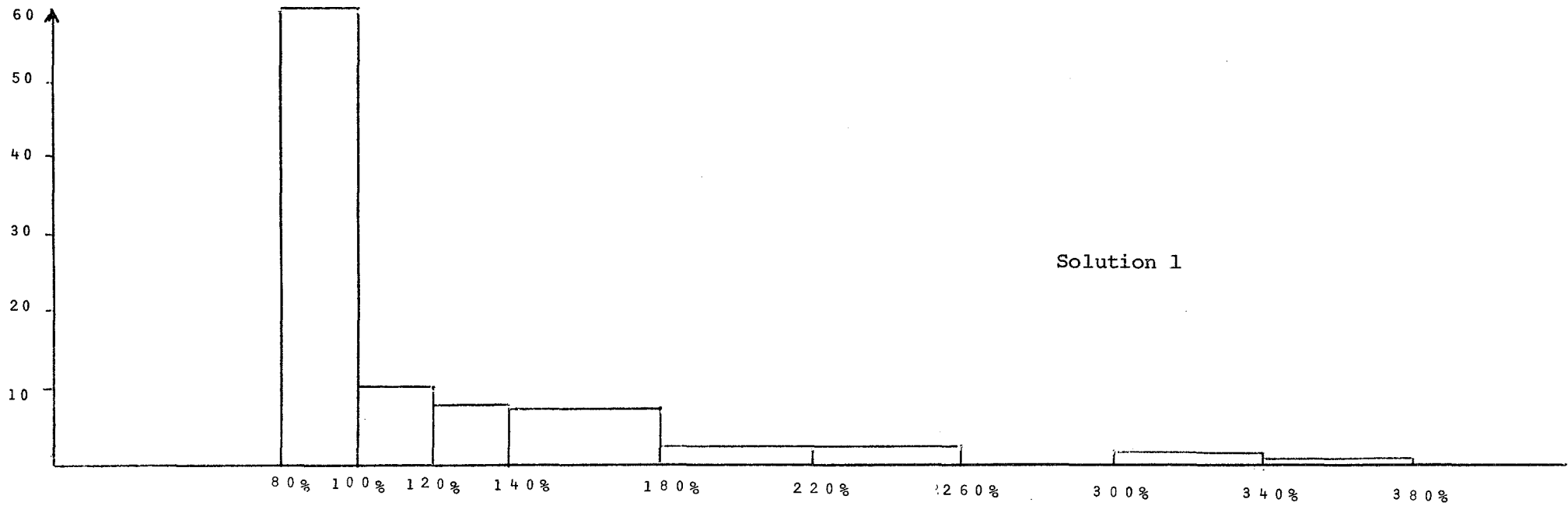
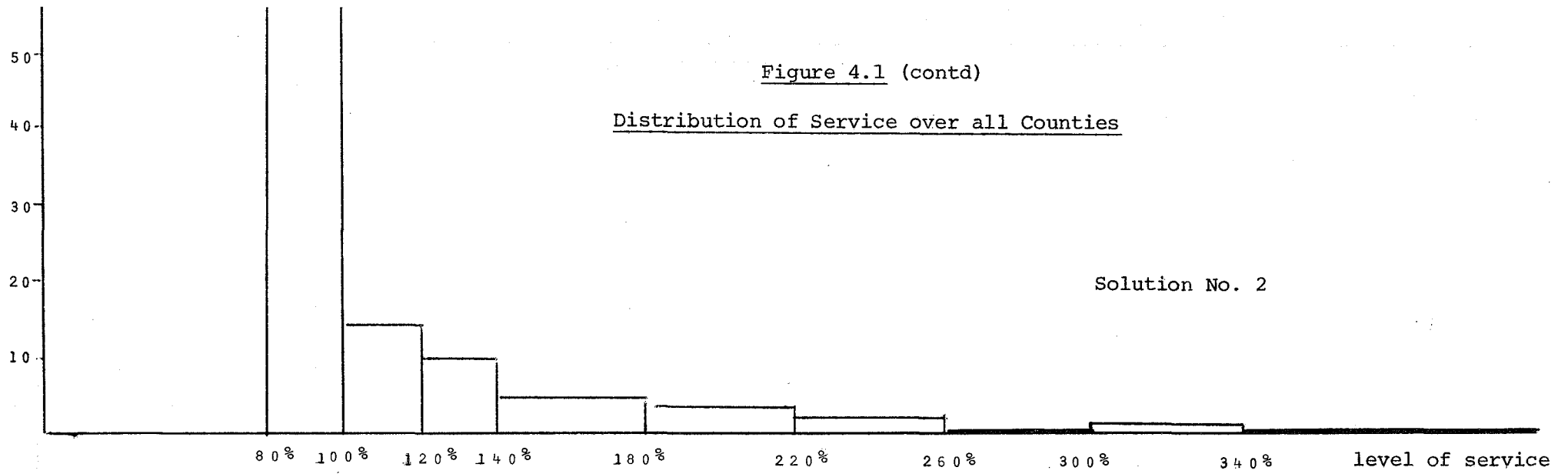
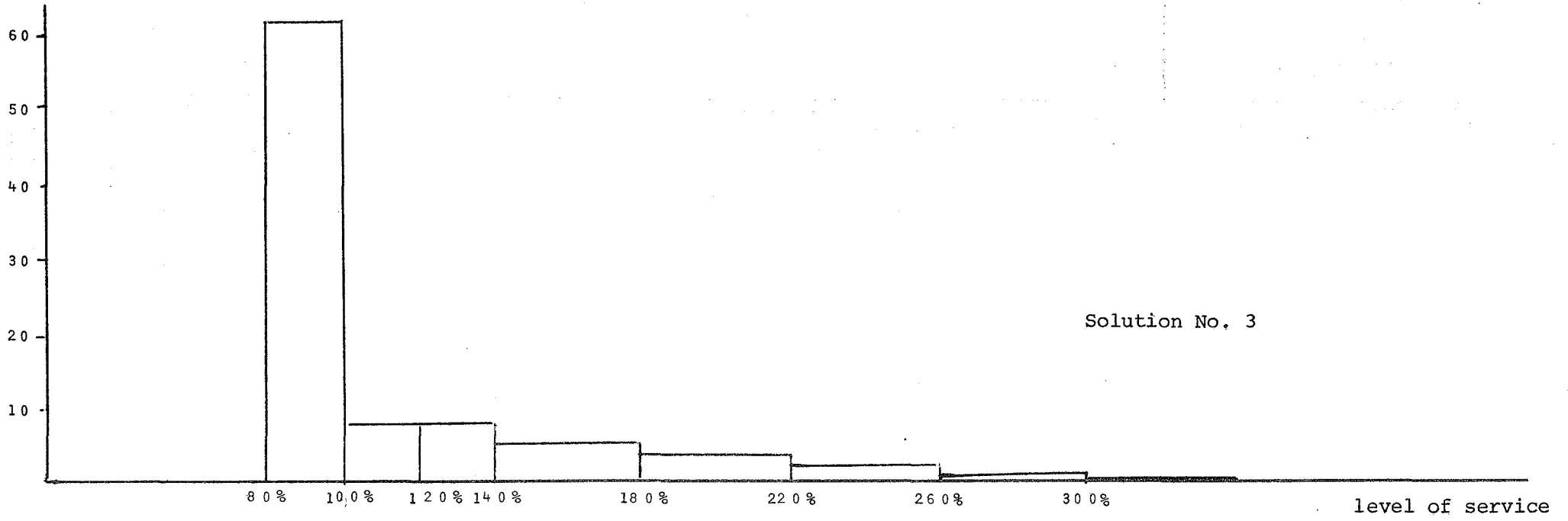


Figure 4.1 (contd)

Distribution of Service over all Counties



no. of counties



It has already been mentioned that farm advisory services should be equitably distributed throughout New Zealand. The variation in the level of service from one county to another is measured by the standard deviation. The three low cost solutions have a smaller standard deviation and therefore give a more even distribution of farm advisory services between counties than does the Ministry's plan.

4.2 Evaluation of Policy Alternatives

Results of investigations of the policy alternatives discussed in Section 2.3 appear in Table 4.3. Modal service levels only are presented. (Policy 1 does not appear in Table 4.3 since it was evaluated using solutions 1, 2 and 3 in Table 4.1).

Policy 1: Altering Regional Boundaries

Interregional servicing, where feasible, was permitted in the models and so an examination of the solutions produced reveal any worthwhile changes to regional boundaries. Only one change was indicated consistently; to move the boundary between regions 1 and 2 slightly northward so that all of Raglan county is included in region 2.

Other changes which occur in one or more of the solutions are:

- (a) Woodville county to be moved from Region 3 to Region 4.

Table 4.3
Solutions Under Policy Constraints

	<u>Policy 2</u> (\$)	<u>Policy 3</u> (\$)	<u>Policy 4</u> (\$)
<u>NORTH ISLAND</u>			
Office costs	75,162	80,278	70,501
Travel costs	112,174	113,573	118,178
Total costs	187,336	193,851	188,679
No. of F.A.O.'s	121	120	121
<u>SOUTH ISLAND</u>			
Office costs	43,985	46,508	36,955
Travel costs	77,074	80,351	82,954
Total costs	121,059	126,859	119,909
No. of F.A.O.'s	64	65	64
<u>NEW ZEALAND</u>			
Office costs	119,147	126,786	107,456
Travel costs	189,248	193,924	201,132
Total costs	308,395	320,710	308,588
No. of F.A.O.'s	185	185	185
Modal service level/county	90%	90%	90%
 Difference between Policy and Solution 1 Table 4.1	 31,556 (11.4%)	 43,871 (15.8%)	 31,749 (11.5%)
 Difference between M.A.F.'s Plan and Policy	 12,214 (3.8%)	 -101 (-0.03%)	 12,021 (3.7%)

- (b) Clutha county to be moved from Region 7 to Region 8.
- (c) Pahiatua county to be moved from Region 3 to Region 4.
- (d) Southern Kaikoura county to be moved from Region 5 to Region 6.

Policy 2: Excluding Regional Headquarters

By placing artificially high office costs on certain offices, the forcing technique can be used to exclude these offices from solutions to the transshipment model.

On the basis of the data provided it was not possible to exclude Hastings completely, as this is the only office from which northern Hawkes Bay can be serviced without violating the constraint on distance travelled. However, all other regional headquarters were excluded and the minimum number of men were stationed at Hastings, producing a solution lower in cost by \$12,214 per annum or 3.8% compared to the Ministry's plan and which provides a higher level of service to farmers. Again, the area where most savings are achieved is in office costs in the North Island. However, compared to solution 1, Table 4.1, Policy 2 requires an additional \$31,556 per annum or 11.4%.

Policy 3: Minimum Office Size

A heuristic rule which can be used to ensure that all offices in the solution are of a minimum size is to artificially set the per unit office costs of smaller

offices to a prohibitively high level in Step 4 of the solution procedure described in Section 3.4. To examine this policy the minimum office size was set at two men. The best solution produced is comparable in cost to the Ministry's plan, which included only two one-man offices and also has a higher level of service. Compared to solution 1, Table 4.1, Policy 3 requires an additional \$43,871, per annum or 15.8%.

Policy 4: Restricted Set of Office Locations

The forcing technique was used to exclude all office sites, except those appearing in the Ministry's plan, from solutions to the transshipment model. The consequent reallocation of farm advisory officers between offices, resulted in an improved solution compared to the Ministry's plan, \$12,021 per annum or 3.7% lower in cost and provides a higher level of service to farmers. However compared to solution 1, Table 4.1, this policy requires an additional \$31,749 per annum or 11.5%

Full details of the best solution produced under policies 2 to 4 inclusive are presented in Appendix F.

4.3 Summary and Conclusions

The heuristic/ satisficing approach has been used previously to solve facility location problems but most applications have been concerned with the location of processing facilities for various commodities.

In this study a model has been developed and the methodology has been adapted to handle the location of a set of service facilities, namely, the offices from which farm advisory officers operate.

A number of low cost solutions have been produced and these have been compared to a tentative plan for the year 1977, provided by the Ministry of Agriculture and Fisheries. The solutions represent a significant saving in the annual cost of providing farm advisory services and a higher level of service to farmers. The model has also been used to explore the consequences of a number of policy alternatives. Nevertheless, only a relatively small number of total Ministry personnel have been investigated and the results cannot be extrapolated for the Ministry as a whole. Thus in practice farm advisory officers might not best be located as indicated because of demands for shared accommodation by other Divisions.

REFERENCES

- (1) HIGHAM, C.R., RODGERS, J.L., McCARTHY, W.O., (1972). Processing Plant Location Studies: II: Policy Alternatives for N.Z. Wool Selling Centres. Agricultural Economics Research Unit Market Research Report No. 2.
- (2) LOGAN, S.H., and KING, G.A. (1962). Economies of Scale in Beel Slaughter Plants. Giannini Foundation Research Report No. 260.
- (3) LOGAN, S.H., and KING, G.A. (1964). Size and Location Factors Affecting California's Beef Slaughtering Plants. *Hilgardia*, Vol. 36: 139-188.
- (4) McCARTHY, W.O., RODGERS, J.L., and HIGHAM, C.R., (1972). Processing Plant Location Studies: I: Theory & A Simple Application to New Zealand Wool Selling Centres. Agricultural Economics Research Unit Market Research Report No. 1.
- (5) RODGERS, J.L., (1975). A Heuristic/Satisficing Approach to a Problem of Facility Location. *New Zealand Operational Research* Vol. 3. No. 1.
- (6) STAMMER, R. (1970). A Mathematical Programming Model for Determining Spatial Organsiation of a Multi-Plant Industry. Unpublished Ph.D Thesis, University of Connecticut.

APPENDIX A.

Possible Office Locations throughout
New Zealand

Office LocationsNORTH ISLAND

Region 1	Region 2	Region 3	Region 4
Auckland (R.H.)	Hamilton (R.H.)	Hastings (R.H.)	Palmerston North (R.H.)
Whangarei (S.R.H.)	Rotorua (S.R.H.)	Gisborne (S.R.H.)	New Plymouth (S.R.H.)
Dargaville	Te Kuiti (S.R.H.)	Dannevirke	Wanganui (S.R.H.)
Kaikohe	Matamata	Masterton	Hawera
Kaitaia	Morrinsville	Ruatoria	Levin
Pukekohe	Taumarunui	Wairoa	Taihape ⁺
Warkworth	Taupo	Pahiatua*	Wellington*
Kerikeri*	Tauranga	Waipukurau*	Marton*
Helensville*	Te Awamutu	Tolaga Bay*	Stratford*
Maungaturoto*	Thames		Feilding*
	Whakatane		
	Opotiki*		
	Huntly*		
	Te Aroha*		
	Te Kauwhata*		

SOUTH ISLAND

Region 5	Region 6	Region 7	Region 8
Nelson (R.H.)	Christchurch (R.H.)	Dunedin (R.H.)	Invercargill (R.H.)
Blenheim (S.R.H.)	Rangiora (S.R.H.)	Oamaru (S.R.H.)	Gore (S.R.H.)
Greymouth (S.R.H.)	Ashburton (S.R.H.)	Alexandra (S.R.H.)	Lumsden*
Motueka	Timaru (S.R.H.)	Balclutha	Te Anau*
Westport	Akaroa	Palmerston	Otautau*
Mapua*	Fairlie	Roxburgh*	
Kaikoura*	Waimate	Queenstown*	
Hokitika*	Darfield ⁺	Ranfurly*	
Takaka*	Geraldine*	Kurow*	
	Methven*		
	Leeston*		
	St. Andrews*		
	Cheviot*		
	Culverden*		
	Pleasant Point*		
	Mayfield*		

N.B. R.H. regional headquarters
 S.R.H. subregional headquarters
 * potential office location
 + currently in operation, but not listed
 in the Ministry's plan

APPENDIX B.

Final Destination Regions

N.B. The number of agricultural holdings/county
was estimated using data published in

Agricultural Statistics,
N.Z. Dept of Statistics.

Final Destination Regions

Region	County	No. of Agric. Holdings	Region	County	No. of Agric. Holdings
1	Mangonui	495	5	Waimea 1	547
	Whangaroa	108		Waimea 2	547
	Nth Hokianga	176		Golden Bay	254
	Sth Hokianga	176		Buller	178
	Bay of Islands	547		Inangahua	119
	Whangarei	1,332		Grey	234
	Hobson	590		Westland	329
	Otamatea	619		Marlborough	723
	Rodney	697		Awatere	182
	Waitemata	875		Kaikoura	216
Franklin	1,449	6	Amuri	193	
Nth Raglan	452		Cheviot	184	
2	Sth Raglan		452	Waipara	334
	Nth Waikato		698	Ashley	335
	Sth Waikato		698	Rangiora	300
	Waipa		1,326	Eyre	260
	Otorohanga		810	Oxford	171
	Waitomo		630	Malvern	444
	Taumarunui		512	Paparua/Waimari/ Heathcote/Mt Herbert	678
	Coromandel		178	Akaroa	164
	Thames	169	Wairewa	108	
	Hauraki Plains	551	Ellesmere	615	
Ohinemuri	261	Ashburton	1,483		
Piako	1,494	Geraldine	581		
Matamata	1,287	Levels	462		
Tauranga	1,243	MacKenzie	283		
Rotorua	640	Waimate	743		
Taupo	149	7	Waitaki 1	423	
Whakatane	655		Waitaki 2	423	
Opotiki	216		Waihemo	163	
3	Waiapu		234	Waikouaiti/ Dunedin Pen.	288
	Waikohu		247	Taieri	439
	Nth Cook		309	Bruce	402
	Sth Cook		309	Clutha	684
	Wairoa		347	Tuapeka	447
	Nth Hawkes Bay		551	Maniototo	224
	Sth Hawkes Bay		551	Vincent	366
	Waipawa	397	Lake	128	
	Waipukurau	136	8	Southland 1	2,700
	Patangata	363		Southland 2	900
Dannevirke	518	Wallace 1		800	
Woodville	247	Wallace 2		326	
Pahiatua	323	TOTAL		53,855	
Akitio	142				
Eketahuna	234				
Masterton	540				
Wairarapa Sth	380				
Featherston	453				
4	Clifton	263			
	Taranaki	636			
	Inglewood	482			
	Egmont/Waimate West	863			
	Stratford	738			
	Eltham/Hawera	733			
	Patea	399			
	Waimarino	207			
	Waitotora	281			
	Wanganui	275			
	Nth Rangitikei	489			
	Sth Rangitikei	489			
	Kiwitea	327			
	Pohangina	178			
	Oroua	445			
	Manawatu	585			
	Kairanga	488			
	Horowhenua	634			
Hutt	197				

APPENDIX C.

Scale Curves for Each Office

N.B. The following costs have been used in deriving scale curves for each office:

1. Office rentals
2. Telephone charges
3. Typing costs
4. Cost of regular travel to subregional headquarters
5. Magazine subscriptions

* indicates a potential office site as opposed to an existing office site.

O F F I C E C O S T C U R V E S

Region	Office Location	Cost Curves			
1	Auckland	$C = 215.00 + 50.00/Q$	$Q \leq 10;$	$C = 215.81 + 4067.05/Q$	$11 \leq Q \leq 15$
	Whangarei	$C = 156.52 + 93.16/Q$	$Q \leq 12;$	$C = 183.91 + 3890.30/Q$	$13 \leq Q \leq 15$
	Dargaville	$C = 321.70 + 206.02/Q$	$Q \leq 2;$	$C = 147.43 + 4413.32/Q$	$3 \leq Q \leq 15$
	Kaikohe	$C = 327.20 + 229.56/Q$	$Q \leq 2;$	$C = 154.29 + 4430.61/Q$	$3 \leq Q \leq 15$
	Kaitaia	$C = 233.55 + 274.72/Q$	$Q \leq 2;$	$C = 116.22 + 4302.17/Q$	$3 \leq Q \leq 15$
	Pukekohe	$C = 148.57 + 111.47/Q$	$Q \leq 13;$	$C = 174.69 + 3849.30/Q$	$14 \leq Q \leq 15$
	Warkworth	$C = 493.96 + 0.00/Q$	$Q = 1;$	$C = 177.73 + 4195.11/Q$	$2 \leq Q \leq 15$
	Kerikeri*	$C = 437.02 + 0.00/Q$	$Q = 1;$	$C = 145.31 + 4140.70/Q$	$2 \leq Q \leq 15$
	Helensville*	$C = 311.36 + 188.62/Q$	$Q \leq 2;$	$C = 141.27 + 4387.72/Q$	$3 \leq Q \leq 15$
	Maungaturata*	$C = 310.26 + 194.28/Q$	$Q \leq 2;$	$C = 141.67 + 4388.23/Q$	$3 \leq Q \leq 15$
2	Hamilton	$C = 204.50 + 50.00/Q$	$Q \leq 6;$	$C = 209.59 + 4008.58/Q$	$7 \leq Q \leq 15$
	Rotorua	$C = 171.10 + 3937.94/Q$	$Q \leq 14;$	$C = 703.79 + 0.00/Q$	$Q = 15$
	Te Kuiti	$C = 363.13 + 0.00/Q$	$Q = 1;$	$C = 138.67 + 4094.84/Q$	$2 \leq Q \leq 15$
	Matamata	$C = 319.35 + 201.88/Q$	$Q \leq 2;$	$C = 147.30 + 4403.32/Q$	$3 \leq Q \leq 15$
	Morrinsville	$C = 319.35 + 173.08/Q$	$Q \leq 2;$	$C = 142.42 + 4392.27/Q$	$3 \leq Q \leq 15$
	Taumarunui	$C = 440.74 + 0.00/Q$	$Q = 1;$	$C = 148.40 + 4145.03/Q$	$2 \leq Q \leq 15$
	Taupo	$C = 328.15 + 218.52/Q$	$Q \leq 2;$	$C = 154.59 + 4422.86/Q$	$3 \leq Q \leq 15$
	Tauranga	$C = 149.49 + 138.00/Q$	$Q \leq 11;$	$C = 203.08 + 3692.43/Q$	$12 \leq Q \leq 15$
	Te Awamutu	$C = 322.65 + 170.50/Q$	$Q \leq 2;$	$C = 143.65 + 4396.25/Q$	$3 \leq Q \leq 15$
	Thames	$C = 321.55 + 225.12/Q$	$Q \leq 2;$	$C = 152.38 + 4415.41/Q$	$3 \leq Q \leq 15$
	Whakatane	$C = 325.95 + 222.64/Q$	$Q \leq 2;$	$C = 154.17 + 4421.15/Q$	$3 \leq Q \leq 15$
	Opotiki*	$C = 313.56 + 266.58/Q$	$Q \leq 2;$	$C = 155.62 + 4420.84/Q$	$3 \leq Q \leq 15$
	Huntly*	$C = 315.76 + 177.50/Q$	$Q \leq 2;$	$C = 141.62 + 4390.04/Q$	$3 \leq Q \leq 15$
	Te Aroha*	$C = 313.56 + 191.70/Q$	$Q \leq 2;$	$C = 142.91 + 4392.19/Q$	$3 \leq Q \leq 15$
	Te Kauwhata*	$C = 310.26 + 192.84/Q$	$Q \leq 2;$	$C = 135.24 + 4419.70/Q$	$3 \leq Q \leq 15$

Region	Office Location	Cost Curves			
3	Hastings	$C = 228.22 + 49.02/Q$	$Q \leq 12;$	$C = 228.07 + 4072.73/Q$	$13 \leq Q \leq 15$
	Gisborne	$C = 156.75 + 80.16/Q$	$Q \leq 13;$	$C = 190.36 + 3687.60/Q$	$14 \leq Q \leq 15$
	Dannevirke	$C = 465.03 + 0.00/Q$	$Q = 1;$	$C = 153.41 + 4158.27/Q$	$2 \leq Q \leq 15$
	Masterton	$C = 157.98 + 249.28/Q$	$Q \leq 13;$	$C = 166.40 + 4359.60/Q$	$14 \leq Q \leq 15$
	Ruatoria	$C = 253.06 + 252.44/Q$	$Q \leq 2;$	$C = 122.48 + 4324.82/Q$	$3 \leq Q \leq 15$
	Wairoa	$C = 321.55 + 233.76/Q$	$Q \leq 2;$	$C = 153.84 + 4418.81/Q$	$3 \leq Q \leq 15$
	Pahiatua*	$C = 318.25 + 285.30/Q$	$Q \leq 2;$	$C = 160.89 + 4433.59/Q$	$3 \leq Q \leq 15$
	Waipukurau*	$C = 314.66 + 193.24/Q$	$Q \leq 2;$	$C = 143.73 + 4394.43/Q$	$3 \leq Q \leq 15$
	Toiāga Bay*	$C = 314.95 + 195.72/Q$	$Q \leq 2;$	$C = 143.90 + 4395.81/Q$	$3 \leq Q \leq 15$
4	Palmerston North	$C = 173.70 + 50.00/Q$	$Q \leq 10;$	$C = 173.70 + 75.01/Q$	$11 \leq Q \leq 15$
	New Plymouth	$C = 148.97 + 3920.46/Q$	$Q \leq 14;$	$C = 680.00 + 0.00/Q$	$Q = 15$
	Wanganui	$C = 345.60 + 0.00/Q$	$Q = 1;$	$C = 129.93 + 4077.55/Q$	$2 \leq Q \leq 15$
	Hawera	$C = 323.75 + 216.68/Q$	$Q \leq 2;$	$C = 152.05 + 4415.56/Q$	$3 \leq Q \leq 15$
	Levin	$C = 419.11 + 0.00/Q$	$Q = 1;$	$C = 150.39 + 4132.53/Q$	$2 \leq Q \leq 15$
	Taihape*	$C = 482.42 + 0.00/Q$	$Q = 1;$	$C = 151.46 + 4151.01/Q$	$2 \leq Q \leq 15$
	Wellington*	$C = 560.40 + 315.92/Q$	$Q \leq 2;$	$C = 286.36 + 4816.72/Q$	$3 \leq Q \leq 15$
	Marton*	$C = 320.45 + 187.58/Q$	$Q \leq 2;$	$C = 145.43 + 4399.48/Q$	$3 \leq Q \leq 15$
	Stratford*	$C = 322.80 + 194.60/Q$	$Q \leq 2;$	$C = 146.12 + 4410.65/Q$	$3 \leq Q \leq 15$
	Feilding*	$C = 328.30 + 178.18/Q$	$Q \leq 2;$	$C = 145.09 + 4416.37/Q$	$3 \leq Q \leq 15$
5	Nelson	$C = 192.60 + 50.00/Q$	$Q \leq 10;$	$C = 192.60 + 75.01/Q$	$11 \leq Q \leq 15$
	Blenheim	$C = 176.78 + 71.08/Q$	$Q \leq 11$	$C = 176.70 + 3822.84/Q$	$12 \leq Q \leq 15$
	Greymouth	$C = 290.75 + 141.68/Q$	$Q \leq 2;$	$C = 122.56 + 4337.43/Q$	$3 \leq Q \leq 15$
	Motueka	$C = 139.28 + 121.08/Q$	$Q \leq 2;$	$C = 158.59 + 4041.58/Q$	$3 \leq Q \leq 15$
	Westport	$C = 290.75 + 233.84/Q$	$Q \leq 2;$	$C = 138.19 + 4372.71/Q$	$3 \leq Q \leq 15$
	Mapua*	$C = 378.32 + 0.00/Q$	$Q = 1;$	$C = 136.64 + 4104.02/Q$	$2 \leq Q \leq 15$
	Kaikoura*	$C = 312.46 + 263.60/Q$	$Q \leq 2;$	$C = 154.55 + 4418.07/Q$	$3 \leq Q \leq 15$
	Hokitika*	$C = 313.56 + 180.18/Q$	$Q \leq 2;$	$C = 140.96 + 4387.78/Q$	$3 \leq Q \leq 15$
		Takaka*	$C = 310.26 + 228.84/Q$	$Q \leq 2;$	$C = 147.54 + 4401.47/Q$	$3 \leq Q \leq 15$

Region	Office Location	Cost Curves			
6	Christchurch	$C = 227.60 + 50.00/Q$	$Q \leq 5;$	$C = 231.46 + 4022.52/Q$	$6 \leq Q \leq 15$
	Rangiora	$C = 166.89 + 3933.90/Q$	$Q \leq 14;$	$C = 699.20 + 0.00/Q$	$Q = 15$
	Ashburton	$C = 160.92 + 3929.42/Q$	$Q \leq 14;$	$C = 692.80 + 0.00/Q$	$Q = 15$
	Timaru	$C = 135.24 + 69.23/Q$	$Q \leq 11;$	$C = 167.38 + 3841.27/Q$	$12 \leq Q \leq 15$
	Akaroa	$C = 319.06 + 209.48/Q$	$Q \leq 2;$	$C = 148.72 + 4407.24/Q$	$3 \leq Q \leq 15$
	Fairlie	$C = 319.06 + 200.84/Q$	$Q \leq 2;$	$C = 147.25 + 4403.93/Q$	$3 \leq Q \leq 15$
	Waimate	$C = 378.75 + 191.44/Q$	$Q \leq 2;$	$C = 175.70 + 4488.28/Q$	$3 \leq Q \leq 15$
	Darfield*	$C = 335.56 + 195.14/Q$	$Q \leq 2;$	$C = 154.67 + 4426.46/Q$	$3 \leq Q \leq 15$
	Geraldine*	$C = 312.46 + 178.64/Q$	$Q \leq 2;$	$C = 140.14 + 4385.54/Q$	$3 \leq Q \leq 15$
	Methven*	$C = 317.30 + 185.46/Q$	$Q \leq 2;$	$C = 141.78 + 4398.90/Q$	$3 \leq Q \leq 15$
	Leeston*	$C = 314.95 + 184.20/Q$	$Q \leq 2;$	$C = 142.06 + 4389.96/Q$	$3 \leq Q \leq 15$
	St. Andrews*	$C = 317.30 + 174.30/Q$	$Q \leq 2;$	$C = 138.84 + 4398.41/Q$	$3 \leq Q \leq 15$
	Cheviot*	$C = 314.95 + 227.40/Q$	$Q \leq 2;$	$C = 149.39 + 4406.49/Q$	$3 \leq Q \leq 15$
	Culverden*	$C = 310.26 + 208.68/Q$	$Q \leq 2;$	$C = 141.60 + 4396.35/Q$	$3 \leq Q \leq 15$
	Pleasant Point*	$C = 317.30 + 175.74/Q$	$Q \leq 2;$	$C = 139.09 + 4398.96/Q$	$3 \leq Q \leq 15$
Mayfield*	$C = 310.26 + 171.24/Q$	$Q \leq 2;$	$C = 137.77 + 4379.41/Q$	$3 \leq Q \leq 15$	
7	Dunedin	$C = 190.50 + 50.00/Q$	$Q \leq 6;$	$C = 195.59 + 4008.58/Q$	$7 \leq Q \leq 15$
	Oamaru	$C = 92.82 + 3878.34/Q$	$Q \leq 14;$	$C = 619.84 + 0.00/Q$	$Q = 15$
	Alexandra	$C = 137.09 + 3914.19/Q$	$Q \leq 14;$	$C = 667.52 + 0.00/Q$	$Q = 15$
	Balclutha	$C = 438.43 + 0.00/Q$	$Q = 1;$	$C = 150.53 + 4142.47/Q$	$2 \leq Q \leq 15$
	Palmerston	$C = 297.06 + 191.64/Q$	$Q \leq 2;$	$C = 134.52 + 4367.46/Q$	$3 \leq Q \leq 15$
	Roxburgh*	$C = 139.46 + 3947.02/Q$	$Q \leq 14;$	$C = 673.66 + 0.00/Q$	$Q = 15$
	Queenstown*	$C = 312.46 + 229.04/Q$	$Q \leq 2;$	$C = 148.69 + 4404.84/Q$	$3 \leq Q \leq 15$
	Ranfurly*	$C = 310.26 + 220.20/Q$	$Q \leq 2;$	$C = 146.07 + 4398.16/Q$	$3 \leq Q \leq 15$
	Kurow*	$C = 314.95 + 207.24/Q$	$Q \leq 2;$	$C = 145.97 + 4398.77/Q$	$3 \leq Q \leq 15$
8	Invercargill	$C = 145.52 + 71.70/Q$	$Q \leq 11;$	$C = 181.37 + 3816.70/Q$	$12 \leq Q \leq 15$
	Gore	$C = 123.91 + 3902.53/Q$	$Q \leq 14;$	$C = 653.23 + 0.00/Q$	$Q = 15$
	Lumsden*	$C = 310.26 + 197.16/Q$	$Q \leq 2;$	$C = 142.16 + 4389.33/Q$	$3 \leq Q \leq 15$
	Te Anau*	$C = 317.15 + 270.80/Q$	$Q \leq 2;$	$C = 157.87 + 4426.41/Q$	$3 \leq Q \leq 15$
	Otautau*	$C = 316.05 + 187.18/Q$	$Q \leq 2;$	$C = 143.13 + 4392.74/Q$	$3 \leq Q \leq 15$

APPENDIX D.

Cost of Travel Data

- N.B. * Indicates that an overnight stay has been included in the cost of travel
- ** Indicates that composite costs and mileages have been used. (This occurs particularly with the larger counties.)
- *+ Indicates that two overnight stays have been included in the cost of travel

Travel Costs

FROM (office)	TO (county)	Visits/ man p.a.	Kilometres/ man p.a.	Travel Costs/ man p.a. (\$)
Auckland	Rodney	259	20,866	1,555
	Waitemata	259	7,309	544
	Franklin	259	12,519	933
Whangarei	Sth Hokianga*	216	9,050	1,581
	Bay of Islands	259	16,692	1,244
	Whangarei	389	4,160	311
	Hobson	259	20,866	1,555
	Otamatea	259	20,866	1,555
Dargaville	Sth Hokianga	259	17,729	1,322
	Bay of Islands*	216	12,528	1,840
	Whangarei	259	20,866	1,555
	Hobson	389	6,260	467
	Otamatea	389	18,779	1,400
Kaikohe	Mangonui**	305	18,170	1,468
	Whangaroa	324	16,686	1,244
	Nth Hokianga	259	16,692	1,244
	Sth Hokianga	389	12,519	933
	Bay of Islands	324	12,506	933
	Whangarei	259	27,138	2,022
Kaitaia	Mangonui	324	10,433	778
	Whangaroa	259	18,792	1,400
	Nth Hokianga	324	12,506	933
Kerikeri	Mangonui**	305	18,170	1,468
	Whangaroa	389	8,359	622
	Nth Hokianga	259	21,902	1,633
	Sth Hokianga	259	17,729	1,322
	Bay of Islands	389	8,359	622
	Whangarei	259	16,692	1,244
Pukekohe	Franklin	389	8,359	622
	Nth Raglan	259	16,692	1,244
	Nth Waikato	259	16,692	1,244
Warkworth	Otamatea	324	18,792	1,400
	Rodney	389	5,210	389
	Waitemata	324	12,506	933
Helensville	Rodney	324	12,506	933
	Waitemata	389	6,260	467
Maungaturoto	Hobson	259	22,965	1,711
	Otamatea	389	6,260	467
	Rodney	324	18,792	1,400
Hamilton	Nth Raglan	324	15,649	1,166
	Sth Raglan	324	18,792	1,400
	Nth Waikato	324	22,939	1,711
	Sth Waikato	389	9,409	700
	Waipa	324	10,433	778
	Otorohanga	324	24,008	1,788
	Piako	454	15,332	1,143
Rotorua	Rotorua	324	16,686	1,244
Te Kuiti	Otorohanga	389	20,879	1,555
	Waitomo	324	16,686	1,244
Matamata	Nth Waikato	389	25,039	1,866
	Sth Waikato	324	24,008	1,788
	Hauraki Plains*	324	15,649	2,527
	Piako	389	15,669	1,166
	Matamata	389	14,619	1,089
Morrinsville	Nth Waikato	389	17,729	1,322
	Sth Waikato	389	15,008	1,120
	Waipa	389	29,199	2,177
	Hauraki Plains	324	13,576	1,011
	Ohinemuri	389	16,680	1,244
	Piako	389	8,359	622
	Matamata	389	25,039	1,866

Travel Costs (cont'd)

FROM (office)	TO (county)	Visits/ man p.a.	Kilometres/ man p.a.	Travel Costs/ man p.a. (\$)
Taumarunui	Taumarunui	324	16,686	1,244
Taupo	Taupo	194	10,439	778
Tauranga	Ohinemuri	389	20,879	1,555
	Tauranga	324	12,506	933
Te Awamutu	Sth Raglan	259	20,866	1,555
	Sth Waikato	389	10,420	778
	Waipa	389	8,359	622
	Otorohanga	324	13,576	1,011
	Waitomo	259	25,039	1,866
	Matamata	324	22,939	1,711
Thames	Coromandel	259	25,039	1,866
	Thames	324	12,506	933
	Hauraki Plains	389	10,420	778
	Ohinemuri	324	14,612	1,089
Whakatane	Whakatane	389	10,420	778
	Opotiki	324	20,866	1,555
Opotiki	Opotiki	389	8,359	622
	Whakatane	389	18,779	1,400
Huntly	Nth Raglan	324	12,506	933
	Sth Raglan	324	18,792	1,400
	Nth Waikato	389	9,409	700
	Sth Waikato	389	10,420	778
	Hauraki Plains	324	18,792	1,400
	Piako	389	16,680	1,244
Te Aroha	Thames**	302	13,563	1,918
	Hauraki Plains	389	14,619	1,089
	Ohinemuri	324	16,686	1,244
	Piako	389	8,359	622
Te Kauwhata	Franklin	389	12,519	933
	Nth Raglan	324	12,506	933
	Sth Raglan	324	20,866	1,555
	Nth Waikato	389	9,409	700
	Sth Waikato	389	12,519	933
	Hauraki Plains	324	16,686	1,244
	Piako	389	14,619	1,089
Hastings	Nth Hawkes Bay	259	16,692	1,244
	Sth Hawkes Bay	389	8,359	622
	Waipawa	259	22,965	1,711
	Waipukurau	259	13,792	1,400
	Patangata*	259	13,556	2,371
Gisborne	Waiapu*	324	18,274	2,744
	Waikohu	259	16,692	1,244
	Nth Cook	259	13,764	1,026
	Sth Cook	259	13,764	1,026
Dannevirke	Waipawa	389	14,619	1,089
	Waipukurau	259	14,619	1,089
	Patangata	259	18,792	1,400
	Dannevirke	389	8,359	622
	Woodville	324	10,433	778
	Pahiatua	259	15,656	1,166
	Akitio	259	20,866	1,555
	Eketahuna**	270	14,606	1,996
Masterton	Woodville	259	25,039	1,866
	Pahiatua	259	21,695	1,617
	Akitio*	194	17,729	2,683
	Eketahuna	324	13,576	1,011
	Masterton	324	12,506	933
	Wairarapa Sth	292	10,410	778
	Featherston	259	25,039	1,866
Ruatoria	Waiapu	259	14,619	1,089
Wairoa	Wairoa	324	12,506	933

Travel Costs (cont'd)

FROM (office)	TO (county)	Visits/ man p.a.	Kilometers/ man p.a.	Travel Costs/ man p.a. (\$)
Pahiatua	Dannevirke	324	17,723	1,322
	Woodville	389	8,359	622
	Pahiatua	389	6,260	467
	Akitio	259	18,792	1,400
	Eketahuna	389	14,619	1,089
	Masterton	324	31,298	2,333
Waipukurau	Sth Hawkes Bay	324	20,866	1,555
	Waipawa	389	12,519	933
	Waipukurau	389	8,359	622
	Patangata	389	10,420	778
	Dannevirke	324	27,119	2,022
	Woodville	259	25,039	1,866
	Pahiatua*	259	15,656	2,527
	Akitio*	194	19,829	2,838
Tolaga Bay	Waiapu**	173	10,437	1,231
	Nth Cook	259	8,346	622
Palmerston North	Woodville	389	10,420	778
	Pahiatua	324	12,506	933
	Kiwitea	259	15,656	1,166
	Pohangina	259	14,619	1,089
	Oroua	259	8,346	622
	Manawatu	389	6,260	467
	Kairanga	389	9,409	700
	Horowhenua	389	18,779	1,400
New Plymouth	Clifton	259	18,792	1,400
	Taranaki	389	5,210	389
	Inglewood	389	10,420	778
	Egmont/Waimate West*	389	13,569	2,372
	Stratford	324	14,612	1,089
	Eltham/Hawera	389	18,779	1,400
Wanganui	Waimarino*	259	18,792	2,760
	Waitotara	389	14,813	1,058
	Wanganui	259	18,792	1,400
	Nth Rangitikei*	194	15,649	2,527
	Sth Rangitikei	259	14,619	1,089
Hawera	Inglewood	389	17,107	1,275
	Egmont/Waimate West	389	19,401	1,446
	Stratford	324	20,866	1,555
	Eltham/Hawera	389	12,519	933
	Patea	389	12,519	933
Levin	Manawatu	389	13,336	995
	Kairanga	389	20,879	1,555
	Horowhenua	389	12,519	933
	Hutt*	259	14,619	2,449
Taihape	Nth Rangitikei	389	16,680	1,244
	Sth Rangitikei*	259	14,619	2,449
	Kiwitea	259	20,866	1,555
Wellington	Masterton*	324	19,829	2,838
	Wairarapa Sth*	324	19,310	2,799
	Featherston*	324	18,792	2,760
	Horowhenua*	324	17,723	2,683
	Hutt	259	16,692	1,244
Marton	Nth Rangitikei*	259	18,792	2,760
	Sth Rangitikei	389	10,420	778
	Kiwitea	259	20,866	1,555
	Pohangina	259	20,866	1,555
	Oroua	324	14,612	1,089
	Manawatu	389	17,535	1,306
	Kairanga	389	22,939	1,711
Stratford	Clifton*	259	17,937	2,698
	Taranaki	454	20,457	1,524
	Inglewood	389	10,031	747
	Egmont/Waimate West	454	22,952	1,709
	Stratford	454	14,606	1,089
	Eltham/Hawera	454	13,563	1,012
	Patea	389	21,267	1,586

Travel Costs (cont'd)

FROM (office)	TO (county)	Visits/ man p.a.	Kilometers/ man p.a.	Travel Costs/ man p.a. (\$)
Feilding	Woodville	389	18,779	1,400
	Nth Rangitikei*	259	17,937	2,698
	Sth Rangitikei	389	13,569	1,011
	Kiwitea	389	17,535	1,306
	Pohangina	259	15,448	1,151
	Oroua	389	12,519	933
	Manawatu	389	10,031	747
	Kairanga	389	13,336	995
Nelson	Waimea 1	389	11,703	871
	Waimea 2*	259	21,902	2,994
Motueka	Waimea 1	389	14,697	1,089
	Waimea 2*	259	21,902	2,994
	Golden Bay**	335	19,822	1,704
Mapua	Waimea 1	389	13,336	995
	Waimea 2*	194	22,959	3,072
	Golden Bay**	335	21,561	1,834
Takaka	Golden Bay	389	10,420	778
Westport	Buller	259	12,519	993
	Inangahua	389	25,039	1,866
Greymouth	Buller*	324	19,829	2,838
	Inangahua	324	29,225	2,177
	Grey	454	10,977	816
	Westland**	302	20,899	3,066
Hokitika	Grey	389	18,779	1,400
	Westland**	346	17,384	2,810
Blenheim	Marlborough	389	20,879	1,555
	Awatere	259	19,829	1,477
	Kaikoura*	324	22,938	3,071
Kaikoura	Kaikoura	389	12,519	933
Cheviot	Amuri	259	25,039	1,866
	Cheviot	389	12,519	933
	Waipara	324	18,792	1,400
	Kaikoura	259	29,212	2,177
Culverden	Amuri	454	10,433	778
	Cheviot*	259	10,446	1,138
	Waipara	324	16,686	1,244
Rangiora	Amuri**	151	5,912	1,196
	Cheviot**	151	5,912	1,196
	Waipara	389	16,686	1,244
	Ashley	518	13,582	1,011
	Rangiora	518	12,545	933
	Eyre	518	16,680	1,244
	Oxford	389	13,764	1,026
	Paparua etc.	389	14,619	1,089
Christchurch	Ashley	324	16,686	1,244
	Rangiora	389	13,764	1,026
	Eyre	454	10,433	778
	Oxford	259	20,866	1,555
	Malvern	259	22,965	1,711
	Paparua etc	454	18,280	1,361
	Wairewa	389	20,879	1,555
	Ellesmere	389	18,779	1,400
Akaroa	Akaroa	324	15,649	1,166
	Wairewa	324	16,686	1,244
Darfield	Malvern	454	14,606	1,089
	Paparua etc	324	20,866	1,555
	Ellesmere	324	16,686	1,244

FROM (office)	TO (county)	Visits/ man p.a.	Kilometers/ man p.a.	Travel Costs/ man p.a. (\$)
Leeston	Malvern	324	14,612	1,089
	Paparua etc	389	13,569	1,011
	Akaroa*	259	16,692	2,605
	Ellesmere	518	16,692	1,244
	Wairewa	388	20,879	1,555
Methven	Ashburton	389	12,519	933
Ashburton	Ellesmere	324	16,686	1,244
	Ashburton	454	18,280	1,361
Mayfield	Ashburton	454	21,909	1,633
	Geraldine	324	15,649	1,166
Geraldine	Ashburton	324	20,866	1,555
	Geraldine	518	20,892	1,555
	Levels	324	16,686	1,244
	MacKenzie	259	21,902	1,633
Fairlie	Geraldine	324	16,686	1,244
	Levels	389	20,879	1,555
	MacKenzie	389	12,519	933
Timaru	Geraldine	389	15,669	1,166
	Levels	454	14,606	1,089
	MacKenzie*	194	20,859	2,916
	Waimate	324	14,612	1,089
Pleasant Point	Geraldine	389	14,619	1,089
	Levels	454	13,154	980
	MacKenzie**	346	14,432	1,302
St. Andrews	Levels	389	13,764	1,026
	Waimate	346	8,364	622
Waimate	Waimate	346	7,638	570
	Waitaki 1	388	18,779	1,400
Kurow	Waimate	324	20,866	1,555
	Waitaki 1	389	18,779	1,400
	Waitaki 2	259	16,692	1,244
Oamaru	Waimate	389	20,879	1,555
	Waitaki 1	454	10,977	816
	Waitaki 2*	259	22,965	3,072
Ranfurly	Waihemo	324	22,932	1,711
	Taieri	259	16,692	1,244
	Maniototo	518	12,545	933
Palmerston	Waitaki 1**	302	12,519	1,840
	Waihemo	454	8,346	621
	Waikouaiti etc	259	14,619	1,089
	Maniototo*	324	16,686	2,605
Dunedin	Waihemo	259	20,866	1,555
	Waikouaiti etc	259	12,519	933
	Taieri	324	16,686	1,244
Alexandra	Vincent	389	16,680	1,244
	Lake*	324	13,576	2,372
	Tuapeka*	324	10,433	2,138
Roxburgh	Tuapeka	389	16,680	1,244
Queenstown	Vincent*	324	16,686	2,605
	Lake	388	16,686	1,244
Balclutha	Tuapeka*	324	10,433	2,138
	Bruce	389	12,519	933
	Clutha	389	14,619	1,089

FROM (office)	TO (county)	Visits/ man p.a.	Kilometers/ man p.a.	Travel Costs/ man p.a.
Invercargill	Clutha*	259	18,792	2,760
	Southland 1	389	12,519	933
	Southland 2*	324	18,792	2,760
	Wallace 1	259	20,866	1,555
	Wallace 2*	324	20,866	2,916
Gore	Clutha	389	16,680	1,244
	Southland 1	389	16,680	1,244
	Southland 2	389	10,420	778
	Wallace 1	324	20,866	1,555
	Wallace 2*	324	18,792	2,760
Lumsden	Southland 1*	324	13,057	2,333
	Southland 2	389	20,879	1,555
	Wallace 1*	324	16,686	2,605
	Wallace 2*	389	10,420	2,138
Te Anau	Wallace 1*	356	23,986	3,151
	Wallace 2	389	20,879	1,555
Otautau	Wallace 1	389	12,519	933
	Wallace 2	259	27,138	2,022

APPENDIX E.

The Ministry of Agriculture & Fisheries¹
Plan and Three Low Cost Solutions

N.B. * indicates a transversal
of a regional boundary

Placement of Farm Advisory Officers
(Ministry of Agriculture and Fisheries' Plan)

NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Auckland	4	Waitemata	4.0
Whangarei	4	Whangarei	4.0
Dargaville	4	Hobson Otamatea	3.1 0.9
Kaikohe	3	Whangaroa Sth Hokianga Bay of Islands	0.2 0.3 2.5
Kaitaia	2	Mangonui Nth Hokianga	1.7 0.3
Pukekohe	5	Franklin	5.0
Warkworth	3	Rodney	3.0
<u>Region 2</u>			
Hamilton	6	Nth Raglan* Sth Raglan Sth Waikato	0.8 0.8 4.4
Rotorua	4	Rotorua	4.0
Te Kuiti	4	Otorohanga Waitomo	1.2 2.8
Matamata	3	Piako Matamata	0.2 2.8
Morrinsville	3	Nth Waikato Piako	1.0 2.0
Taumarunui	3	Taumarunui	3.0
Taupo	2	Taupo	2.0
Tauranga	4	Tauranga	4.0
Te Awamutu	3	Waipa	3.0
Thames	3	Coromandel Thames Hauraki Plains Ohinemuri	0.4 0.3 1.8 0.5
Whakatane	3	Whakatane Opotiki	2.6 0.4
<u>Region 3</u>			
Hastings	7	Nth Hawkes Bay Sth Hawkes Bay	1.2 5.8
Gisborne	5	Waikohu Nth Cook Sth Cook	0.5 3.8 0.7
Dannevirke	4	Waipawa Waipukurau Patangata Dannevirke Woodville Akitio	0.6 0.3 0.8 1.6 0.4 0.3

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Masterton	5	Eketahuna	0.4
		Masterton	1.0
		Wairarapa Sth	2.6
		Featherston	1.0
Ruatoria	2	Waiapu	2.0
Wairoa	3	Wairoa	3.0
<u>Region 4</u>			
Palmerston North	8	Pahiatua*	0.6
		Kiwitea	0.7
		Pohangina	0.4
		Oroua	1.0
		Manawatu	4.6
		Kairanga	0.7
New Plymouth	6	Clifton	0.6
		Taranaki	5.4
Wanganui	4	Waimarino	0.5
		Waitotora	0.4
		Wanganui	0.6
		Nth Rangitikei	1.4
		Sth Rangitikei	1.1
Hawera	5	Inglewood	0.7
		Egmont/Waimate West	1.3
		Stratford	1.3
		Eltham/Hawera	1.1
		Patea	0.6
Levin	2	Horowhenua	1.6
		Hutt	0.4

North Island Totals

Office costs	=	\$ 93,301
Travel costs	=	\$101,336
Total costs	=	\$194,637
No. of F.A.O.'s	=	114

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Nelson	3	Waimea 1	3.0
Motueka	2	Waimea 1	0.4
		Waimea 2	1.2
		Golden Bay	0.4
Westport	2	Buller	1.8
		Inangahua	0.2
Greymouth	2	Grey	1.4
		Westland	0.6
Blenheim	4	Awatere	2.5
		Malborough	1.1
		Kaikoura	0.4

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 6</u>			
Rangiora	6	Amuri	0.7
		Cheviot	0.7
		Waipara	0.5
		Ashley	0.4
		Rangiora	2.5
		Oxford	0.2
		Paparua etc.	1.0
Christchurch	6	Eyre	5.0
		Malvern	1.0
Akaroa	1	Akaroa	0.8
		Wairewa	0.2
Ashburton	5	Ellesmere	3.1
		Ashburton	1.9
Fairlie	2	MacKenzie	2.0
Timaru	6	Geraldine	0.9
		Levels	5.1
Waimate	2	Waimate	2.0
<u>Region 7</u>			
Oamaru	4	Waitaki 1	3.1
		Waitaki 2	0.9
Palmerston	1	Waihemo	0.6
		Maniototo	0.4
Dunedin	3	Waikouaiti etc.	2.2
		Taieri	0.8
Alexandra	4	Vincent	3.0
		Lake	0.2
		Tuapeka	0.8
Balclutha	4	Clutha	1.0
		Bruce	3.0
<u>Region 8</u>			
Invercargill	8	Southland 1	8.0
Gore	6	Southland 2	4.0
		Wallace 1	1.4
		Wallace 2	0.6
<u>South Island Totals</u>			
Office costs	=	\$ 43,851	
Travel costs	=	\$ 82,121	
Total costs	=	\$125,972	
No of F.A.O.'s	=	71	
<u>New Zealand Totals</u>			
Office costs	=	\$137,152	
Travel costs	=	\$183,457	
Total costs	=	\$320,609	
No. of F.A.O.'s	=	185	

Placement of Farm Advisory Officers

(Solution No. 1)

NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Auckland	4	Waitemata	4.0
Whangarei	6	Whangarei	6.0
Dargaville	2	Hobson	2.0
Kaikohe	2	Sth Hokianga	0.4
		Bay of Islands	1.6
Kaitaia	2	Mangonui	1.5
		Nth Hokianga	0.5
Kerikeri	1	Whangaroa	1.0
Pukekohe	6	Franklin	6.0
Helensville	2	Rodney	2.0
Maungaturoto	2	Otamatea	2.0
<u>Region 2</u>			
Hamilton	6	Sth Waikato	2.3
		Waipa	1.4
		Nth Raglan*	1.0
		Sth Raglan	1.3
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga	1.9
		Waitomo	2.1
Morrinsville	9	Hauraki Plains	0.6
		Piako	4.7
		Matamata	3.1
		Ohinemuri	0.6
Taumarunui	2	Taumarunui	2.0
Taupo	1	Taupo	1.0
Tauranga	5	Tauranga	5.0
Te Awamutu	2	Waipa	2.0
Thames	2	Coromandel	0.6
		Thames	0.5
		Hauraki Plains	0.9
Whakatane	2	Whakatane	2.0
Opotiki	1	Opotiki	1.0
Huntly	2	Nth Waikato	1.7
		Nth Raglan*	0.3
<u>Region 3</u>			
Hastings	5	Nth Hawkes Bay	1.9
		Sth Hawkes Bay	2.9
		Waipukurau	0.2
Gisborne	5	Waikohu	0.9
		Nth Cook	3.0
		Sth Cook	1.1
Dannevirke	1	Dannevirke	1.0
Masterton	7	Eketahuna	0.7
		Masterton	1.5
		Wairarapa Sth	3.2
		Featherston	1.6
Ruatoria	1	Waiapu	1.0
Wairoa	1	Wairoa	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Pahiatua	2	Dannevirke	0.3
		Woodville	0.5
		Pahiatua	0.7
		Akitio	0.5
Waipukurau	2	Waipawa	0.9
		Patangata	0.9
		Waipukurau	0.2
<u>Region 4</u>			
Palmerston North	11	Woodville*	0.1
		Pohangina	1.0
		Oroua	1.6
		Manawatu	6.0
		Kairanga	1.1
		Horowhenua	1.2
New Plymouth	9	Clifton	0.9
		Taranaki	3.5
		Inglewood	1.1
		Eltham/Hawera	1.4
		Stratford	2.1
Wanganui	3	Waimarino	0.7
		Waitotora	1.3
		Wanganui	1.0
Hawera	1	Patea	1.0
Levin	1	Hutt	0.7
		Horowhenua	0.3
Taihape	2	Nth Rangitikei	2.0
Marton	2	Sth Rangitikei	2.0
Stratford	2	Egmont/Waimate West	1.7
		Eltham/Hawera	0.3
Feilding	1	Kiwitea	0.8
		Oroua	0.2

North Island Totals

Office costs	=	\$ 59,175
Travel costs	=	\$109,239
Total costs	=	\$168,414
No. of F.A.O.'s	=	121

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Nelson	4	Waimea 1	2.0
		Waimea 2	2.0
Takaka	1	Golden Bay	1.0
Westport	2	Buller	1.7
		Inangahua	0.3
Greymouth	1	Grey	1.0
Hokitika	1	Westland	0.9
		Grey	0.1
Blenheim	3	Awatere	1.1
		Malborough	1.9
Kaikoura	1	Kaikoura	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 6</u>			
Cheviot	1	Cheviot	1.0
Culverden	1	Amuri	1.0
Rangiora	4	Waipara	0.8
		Ashley	0.6
		Rangiora	2.2
		Oxford	0.4
Christchurch	1	Eyre	1.0
Akaroa	2	Akaroa	1.7
		Wairewa	0.3
Darfield	1	Malvern	1.0
Leeston	2	Paparua etc.	2.0
Ashburton	5	Ellesmere	1.9
		Ashburton	3.1
Fairlie	1	MacKenzie	1.0
Timaru	3	Geraldine	1.4
		Levels	1.0
		Waimate	0.6
St. Andrews	2	Waimate	2.0
Waimate	1	Waimate	1.0
<u>Region 7</u>			
Kurow	2	Waitaki 1	0.5
		Waitaki 2	1.5
Ranfurly	1	Maniototo	1.0
Palmerston	1	Waihemo	0.3
		Waitaki 1	0.7
Dunedin	3	Waikouaiti etc.	1.7
		Taieri	1.3
Alexandra	3	Vincent	1.7
		Tuapeka	1.3
Queenstown	1	Lake	1.0
Balclutha	1	Bruce	1.0
<u>Region 8</u>			
Invercargill	7	Southland 1	7.0
Gore	5	Clutha*	1.6
		Southland 2	3.4
Te Anau	1	Wallace 2	1.0
Otautau	2	Wallace 1	2.0

South Island Totals

Office costs = \$ 34,214

Travel costs = \$ 74,211

Total costs = \$108,425

No. of F.A.O.'s = 64

New Zealand Totals

Office costs = \$ 93,389

Travel costs = \$183,450

Total costs = \$276,839

No. of F.A.O.'s = 185

Placement of Farm Advisory Officers(Solution No. 2)NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Auckland	4	Waitemata	4.0
Whangarei	4	Whangarei	4.0
Dargaville	2	Hobson	2.0
Kaikohe	2	Sth Hokianga	1.3
		Bay of Islands	0.7
Kaitaia	2	Mangonui	1.5
		Nth Hokianga	0.5
Kerikeri	1	Whangaroa	0.3
		Bay of Islands	0.7
Pukekohe	6	Franklin	6.0
Warkworth	2	Rodney	2.0
Maungaturoto	2	Otamatea	2.0
<u>Region 2</u>			
Hamilton	6	Sth Raglan	0.3
		Sth Waikato	4.3
		Waipa	1.4
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga	1.9
		Waitomo	2.1
Matamata	2	Matamata	2.0
Morrinsville	7	Hauraki Plains	0.6
		Ohinemuri	0.6
		Piako	4.7
		Matamata	1.1
Taumarunui	2	Taumarunui	2.0
Taupo	1	Taupo	1.0
Tauranga	5	Tauranga	5.0
Te Awamutu	2	Waipa	2.0
Thames	2	Coromandel	0.6
		Thames	0.5
		Hauraki Plains	0.9
Whakatane	2	Whakatane	2.0
Opotiki	1	Opotiki	1.0
Huntly	2	Nth Raglan*	1.0
		Sth Raglan	1.0
Te Kauwhata	2	Nth Raglan*	0.3
		Nth Waikato	1.7
<u>Region 3</u>			
Hastings	5	Nth Hawkes Bay	2.0
		Sth Hawkes Bay	2.8
		Waipukurau	0.2
Gisborne	3	Waikohu	0.9
		Nth Cook	1.0
		Sth Cook	1.1

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Masterton	8	Eketahuna	0.7
		Masterton	1.6
		Wairarapa Sth	4.1
		Featherston	1.6
Ruatoria	1	Waiapu	1.0
Wairoa	1	Wairoa	1.0
Pahiatua	2	Dannevirke	1.5
		Akitio	0.5
Waipukurau	2	Waipawa	1.0
		Waipukurau	0.2
		Patangata	0.8
Tolaga Bay	2	Nth Cook	2.0
<u>Region 4</u>			
Palmerston North	11	Woodville*	0.6
		Pahiatua*	0.9
		Oroua	1.4
		Manawatu	5.4
		Kairanga	1.2
		Horowhenua	1.5
New Plymouth	9	Clifton	0.9
		Taranaki	3.3
		Inglewood	1.2
		Stratford	2.1
		Eltham/Hawera	1.5
Wanganui	5	Waimarino	0.7
		Waitotora	1.5
		Wanganui	1.0
		Sth Rangitikei	1.8
Hawera	1	Patea	1.0
Taihape	2	Nth Rangitikei	1.2
		Kiwitea	0.8
Wellington	1	Hutt	1.0
Stratford	2	Egmont/Waimate	1.7
		Eltham/Hawera ^{West}	0.3
Feilding	1	Kiwitea	0.2
		Pohangina	0.7
		Oroua	0.1

North Island Totals

Office costs = \$64,061
Travel costs = \$107,026
Total costs = \$171,087
No. of F.A.O.'s = 121

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Nelson	4	Waimea 1	2.0
		Waimea 2	2.0
Takaka	1	Golden Bay	1.0
Westport	2	Buller	1.7
		Inangahua	0.3
Greymouth	2	Grey	1.0
		Westland	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Blenheim	3	Awatere Marlborough	1.1 1.9
Kaikoura	1	Kaikoura	1.0
<u>Region 6</u>			
Cheviot	1	Cheviot	1.0
Culverden	2	Amuri	2.0
Rangiora	3	Waipara Ashley Rangiora Oxford	0.8 0.6 1.2 0.4
Christchurch	1	Eyre	1.0
Akaroa	2	Akaroa Wairewa	1.7 0.3
Darfield	1	Malvern	1.0
Leeston	2	Paparua etc	2.0
Ashburton	5	Ellesmere Ashburton	1.9 3.1
Fairlie	1	MacKenzie	1.0
Timaru	3	Geraldine Levels Waimate	1.4 1.0 0.6
St. Andrews	1	Waimate	1.0
Waimate	2	Waimate	2.0
<u>Region 7</u>			
Kurow	2	Waitaki 1 Waitaki 2	0.5 1.5
Ranfurly	1	Maniototo	1.0
Palmerston	1	Waitaki 1 Wainemo	0.7 0.3
Dunedin	3	Waikouaiti etc. Taieri	1.7 1.3
Alexandra	3	Vincent Tuapeka	1.7 1.3
Queenstown	1	Lake	1.0
Balclutha	3	Bruce Clutha	1.4 1.6
<u>Region 8</u>			
Invercargill	7	Southland 1	7.0
Gore	3	Southland 2	3.0
Te Anau	1	Wallace 2	1.0
Otautau	2	Wallace 1	2.0

South Island Totals

Office costs	=	\$38,129
Travel costs	=	\$74,215
Total costs	=	\$112,344
No. of F.A.O.'s	=	64

New Zealand Totals

Office costs	=	\$102,190
Travel costs	=	\$181,241
Total Costs	=	\$283,431
No. of F.A.O.'s	=	185

Placement of Farm Advisory Officers(Solution No. 3)NORTH ISLAND

Office	No. of F.A.O's	County	No. of F.A.O.'s
<u>Region 1</u>			
Auckland	4	Waitemata	4.0
Whangarei	4	Whangarei Otamatea	3.2 0.8
Dargaville	2	Hobson Otamatea	1.4 0.6
Kaikohe	4	Sth Hokianga Bay of Islands	0.4 3.6
Kaitaia	2	Mangonui Nth Hokianga	1.5 0.5
Kerikeri	1	Whangaroa	1.0
Pukekohe	4	Franklin	4.0
Warkworth	2	Otamatea Rodney	0.4 1.6
Helensville	2	Rodney Waitemata	0.1 1.9
<u>Region 2</u>			
Hamilton	6	Nth Raglan* Sth Raglan Sth Waikato Waipa	0.9 1.3 2.4 1.4
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga Waitomo	1.9 2.1
Matamata	5	Matamata	5.0
Morrinsville	5	Piako	5.0
Taumarunui	2	Taumarunui	2.0
Taupo	1	Taupo	1.0
Tauranga	4	Tauranga	4.0
Te Awamutu	2	Waipa	2.0
Thames	4	Coromandel Thames Hauraki Plains Ohinemuri	0.6 0.5 2.2 0.7
Whakatane	2	Whakatane	2.0
Opotiki	1	Opotiki	1.0
Huntly	2	Nth Raglan* Nth Waikato	0.4 1.6
<u>Region 3</u>			
Hastings	4	Nth Hawkes Bay Sth Hawkes Bay	2.0 2.0
Gisborne	3	Waikohu Sth Cook	0.9 2.1

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Dannevirke	4	Waipawa	0.2
		Dannevirke	3.3
		Akitio	0.5
Masterton	7	Eketahuna	0.7
		Masterton	1.6
		Wairarapa Sth	3.1
		Featherston	1.6
Ruatoria	1	Waiapu	1.0
Wairoa	1	Wairoa	1.0
Pahiatua	2	Woodville	0.6
		Pahiatua	1.4
Waipukurau	2	Waipawa	0.8
		Waipukurau	0.3
		Patangata	0.9
Tolaga Bay	2	Nth Cook	2.0
<u>Region 4</u>			
Palmerston North	9	Oroua	1.4
		Manawatu	4.9
		Kairanga	1.2
		Horowhenua	1.5
New Plymouth	7	Clifton	0.9
		Taranaki	3.0
		Inglewood	1.2
		Stratford	1.9
Wanganui	5	Waimarino	0.7
		Waitotora	1.5
		Wanganui	1.0
		Sth Rangitikei	1.8
Hawera	5	Egmont/Waimate	
		West	2.1
		Stratford	0.2
		Eltham/Hawera	1.8
Patea			0.9
Taihape	2	Nth Rangitikei	1.2
		Kiwitea	0.8
Wellington	1	Hutt	1.0
Feilding	1	Kiwitea	0.2
		Pohangina	0.7
		Oroua	0.1

North Island Totals

Office costs = \$82,658
 Travel costs = \$104,585
 Total costs = \$187,243
 No. of F.A.O.'s = 121

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Nelson	4	Waimea 1	2.1
		Waimea 2	1.9
Takaka	1	Golden Bay	1.0
Westport	2	Buller	1.7
		Inangahua	0.3
Greymouth	1	Grey	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Hokitika	1	Grey	0.1
		Westland	0.9
Blenheim	4	Awatere	2.0
		Malborough	1.8
		Kaikoura	0.2
<u>Region 6</u>			
Cheviot	1	Kaikoura*	0.6
		Cheviot	0.4
Culverden	2	Amuri	2.0
Rangiora	5	Waipara	0.8
		Ashley	0.6
		Rangiora	1.6
		Oxford	0.4
		Paparua etc	1.6
Christchurch	4	Eyre	2.6
		Ellesmere	1.4
Akaroa	1	Akaroa	0.7
		Wairewa	0.3
Darfield	1	Malvern	0.9
		Ellesmere	0.1
Ashburton	3	Ashburton	3.0
Fairlie	1	MacKenzie	1.0
Timaru	3	Geraldine	1.4
		Levels	0.9
		Waimate	0.7
Waimate	2	Waimate	2.0
<u>Region 7</u>			
Oamaru	3	Waitaki 1	1.5
		Waitaki 2	1.5
Ranfurly	1	Maniototo	1.0
Palmerston	1	Waihemo	1.0
Dunedin	3	Waikouaiti etc.	1.8
		Taieri	1.2
Alexandra	1	Vincent	0.9
		Tuapeka	0.1
Queenstown	1	Lake	1.0
Balclutha	5	Bruce	2.3
		Tuapeka	1.1
		Clutha	1.6
<u>Region 8</u>			
Invercargill	8	Southland 1	8.0
Gore	3	Southland 2	2.2
		Wallace 2	0.8
Otautau	2	Wallace 1	1.9
		Wallace 2	0.1

South Island Totals

Office costs = \$39,870
 Travel costs = \$77,318
 Total costs = \$117,188
 No. of F.A.O.'s = 64

New Zealand Totals

Office costs = \$122,528
 Travel costs = \$181,903
 Total costs = \$304,431
 No. of F.A.O.'s = 185

APPENDIX F.

Solutions under Policy Alternatives

N.B. * indicates a transversal
of an existing regional boundary

Placement of Farm Advisory Officers
(Policy 2 - Excluding Regional Headquarters)

NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Whangarei	6	Whangarei	6.0
Dargaville	2	Hobson	2.0
Kaikohe	2	Sth Hokianga	1.3
		Bay of Islands	0.7
Kaitaia	2	Mangonui	1.5
		Nth Hokianga	0.5
Kerikeri	1	Whangaroa	0.3
		Bay of Islands	0.7
Pukekohe	7	Franklin	7.0
Helensville	5	Rodney	2.0
		Waitemata	3.0
Maungaturoto	2	Otamatea	2.0
<u>Region 2</u>			
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga	1.9
		Waitemata	2.1
Morrinsville	9	Hauraki Plains	0.6
		Ohinemuri	0.6
		Piako	4.7
		Matamata	3.1
Taumarunui	2	Taumarunui	2.0
Taupo	1	Taupo	1.0
Tauranga	5	Tauranga	5.0
Te Awamutu	6	Sth Raglan	0.4
		Sth Waikato	1.7
		Waipa	3.9
Thames	2	Thames	0.5
		Coromandel	0.6
		Hauraki Plains	0.9
Whakatane	2	Whakatane	2.0
Opotiki	1	Opotiki	1.0
Huntly	2	Sth Raglan	1.0
		Nth Waikato	1.0
Te Kauwhata	2	Nth Raglan*	1.3
		Nth Waikato	0.7
<u>Region 3</u>			
Hastings	2	Nth Hawkes Bay	2.0
Gisborne	3	Waikohu	0.9
		Nth Cook	1.0
		Sth Cook	1.1
Dannevirke	1	Dannevirke	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Masterton	7	Eketahuna	0.7
		Masterton	1.6
		Wairarapa Sth	3.1
		Featherston	1.6
Ruatoria	1	Waiapu	1.0
Wairoa	1	Wairoa	1.0
Pahiatua	2	Dannevirke	0.1
		Woodville	0.6
		Pahiatua	0.8
		Akitio	0.5
Waipukurau	7	Sth Hawkes Bay	1.6
		Waipawa	0.9
		Waipukurau	3.4
		Patangata	0.9
		Dannevirke	0.2
Tolaga Bay	2	Nth Cook	2.0
<u>Region 4</u>			
New Plymouth	9	Clifton	0.9
		Taranaki	3.3
		Inglewood	1.2
		Stratford	2.1
		Eltham/Hawera	1.5
Wanganui	5	Waimarino	0.7
		Waitotora	2.6
		Wanganui	1.0
		Sth Rangitikei	0.7
Hawera	1	Patea	1.0
Levin	6	Manawatu	1.4
		Horowhenua	4.6
Taihape	2	Nth Rangitikei	1.2
		Kiwitea	0.8
Wellington	1	Hutt	1.0
Marton	2	Sth Rangitikei	0.7
		Oroua	1.3
Stratford	2	Egmont/Waimate	1.7
		Eltham/Hawera	0.3
Feilding	2	Pohangina	0.7
		Kairanga	1.1
		Kiwitea	0.2

North Island Totals

Office costs = \$75,162
Travel costs = \$112,174
Total costs = \$187,336
No. of F.A.O.'s = 121

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Motueka	4	Waimea 1	2.0
		Waimea 2	2.0
Takaka	1	Golden Bay	1.0
Westport	2	Buller	1.7
		Inangahua	0.3
Greymouth	1	Grey	1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Hokitika	1	Grey	0.1
		Westland	0.9
Blenheim	3	Awatere	1.1
		Marlborough	1.9
Kaikoura	1	Kaikoura	1.0
<u>Region 6</u>			
Cheviot	1	Cheviot	1.0
Culverden	2	Amuri	2.0
Rangiora	4	Waipara	0.8
		Ashley	0.6
		Rangiora	1.7
		Eyre	0.5
		Oxford	0.4
Akaroa	2	Akaroa	1.7
		Wairewa	0.3
Darfield	1	Malvern	1.0
Leeston	2	Paparua etc	2.0
Ashburton	5	Ellesmere	1.9
		Ashburton	3.1
Fairlie	1	MacKenzie	1.0
Timaru	3	Geraldine	1.4
		Levels	1.0
		Waimate	0.6
St. Andrews	2	Waimate	2.0
Waimate	1	Waimate	1.0
<u>Region 7</u>			
Kurow	2	Waitaki 1	0.5
		Waitaki 2	1.5
Ranfurlly	3	Waihemo	0.1
		Taieri	1.6
		Maniototo	1.3
Palmerston	2	Waitaki 1	0.7
		Waihemo	0.3
		Waikouaiti etc	1.0
Alexandra	3	Vincent	1.7
		Tuapeka	1.3
Queenstown	1	Lake	1.0
Balclutha	1	Bruce	1.0
<u>Region 8</u>			
Gore	12	Clutha*	1.6
		Southland 1	6.5
		Southland 2	3.9
Te Anau	1	Wallace 2	1.0
Otautau	2	Wallace 1	2.0

South Island Totals

Office costs = \$43,985
Travel costs = \$77,074
Total costs = \$121,059
No. of F.A.O.'s = 64

New Zealand Totals

Office costs = \$119,147
Travel costs = \$189,248
Total costs = \$308,395
No. of F.A.O.'s = 185

Placement of Farm Advisory Officers
(Policy 3 - Minimum Office Size)

NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Whangarei	6	Whangarei	6.0
Dargaville	2	Hobson	2.0
Kaikohe	3	Whangaroa	0.3
		Sth Hokianga	1.1
		Bay of Islands	1.6
Kaitiāia	2	Mangonui	1.5
		Nth Hokianga	0.5
Pukekohe	6	Franklin	6.0
Helensville	4	Rodney	1.9
		Waitemata	2.1
Maungaturoto	2	Otamatea	2.0
<u>Region 2</u>			
Hamilton	9	Nth Raglan*	0.9
		Sth Raglan	1.3
		Sth Waikato	2.7
		Waipa	3.8
		Piako	0.3
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga	1.9
		Waitomo	2.1
Morrinsville	5	Hauraki Plains	0.5
		Piako	3.1
		Matamata	1.4
Taumarunui	2	Taumarunui	2.0
Taupo	2	Taupo	2.0
Tauranga	5	Ohinemuri	0.6
		Tauranga	4.4
Te Awamutu	2	Matamata	2.0
Thames	2	Coromandel	0.6
		Thames	0.5
		Hauraki Plains	0.9
Whakatane	3	Whakatane	2.4
		Opotiki	0.6
Huntly	2	Nth Raglan*	0.4
		Nth Waikato	1.6
<u>Region 3</u>			
Hastings	5	Nth Hawkes Bay	1.9
		Sth Hawkes Bay	2.9
		Waipukurau	0.2
Gisborne	3	Waikohu	0.9
		Nth Cook	1.0
		Sth Cook	1.1
Masterton	8	Eketahuna	0.7
		Masterton	1.5
		Wairarapa South	4.2
		Featherston	1.6

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Wairoa	2	Wairoa	2.0
Pahiatua	2	Dannevirke Akitio	1.5 0.5
Waipukurau	2	Waipawa Waipukurau Patangata	0.9 0.2 0.9
Tolaga Bay	2	Waiapu Nth Cook	1.2 0.8
<u>Region 4</u>			
Palmerston North	9	Pahiatua* Woodville* Pohangina Oroua Manawatu Kairanga	0.9 0.6 0.6 1.6 4.1 1.2
New Plymouth	9	Clifton Taranaki Inglewood Stratford Eltham/Hawera	0.9 3.5 1.1 2.1 1.4
Wanganui	5	Waimarino Waitotora Wanganui Sth Rangitikei	0.7 1.6 1.0 1.7
Levin	3	Horowhenua Hutt	2.3 0.7
Taihape	4	Nth Rangitikei Kiwitea	2.8 1.2
Stratford	3	Egmont/Waimate West Eltham/Hawera Patea	1.7 0.3 1.0

North Island Totals

Office costs = \$80,278
 Travel costs = \$113,573
 Total costs = \$193,851
 No. of F.A.O.'s = 120

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 5</u>			
Nelson	2	Waimea 1	2.0
Motueka	3	Waimea 1 Waimea 2 Golden Bay	0.4 1.9 0.7
Westport	2	Buller Inangahua	1.7 0.3
Greymouth	2	Grey Westland	1.0 1.0
Blenheim	4	Awatere Marlborough Kaikoura	1.9 1.8 0.3
<u>Region 6</u>			
Cheviot	2	Kaikoura* Amuri Cheviot Waipara	0.4 0.2 0.4 1.0

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Rangiora	4	Amuri	0.9
		Ashley	0.6
		Rangiora	0.5
		Oxford	0.4
		Paparua etc	1.6
Christchurch	3	Eyre	3.0
Akaroa	2	Akaroa	1.7
		Wairewa	0.3
Darfield	3	Malvern	1.3
		Ellesmere	1.7
Ashburton	3	Ashburton	3.0
Fairlie	3	Geraldine	1.6
		MacKenzie	1.4
Timaru	2	Levels	0.9
<u>Region 7</u>		Waimate	1.1
Kurow	2	Waimate*	0.5
		Waitaki 2	1.5
Oamaru	3	Waimate*	0.5
		Waitaki 1	2.5
Ranfurly	2	Waihemo	0.5
		Maniototo	1.5
Dunedin	3	Waikouaiti etc	1.8
		Taieri	1.2
Alexandra	4	Vincent	2.4
		Lake	0.4
		Tuapeka	1.2
Balclutha	3	Bruce	1.4
		Clutha	1.6
<u>Region 8</u>			
Invercargill	7	Southland 1	7.0
Gore	4	Southland 2	3.2
		Wallace 2	0.8
Otautau	2	Wallace 1	1.9
		Wallace 2	0.1

South Island Totals

Office costs = \$46,508
 Travel costs = \$80,351
 Total costs = \$126,859
 No. of F.A.O.'s = 65

New Zealand Totals

Office costs = \$126,786
 Travel costs = \$193,924
 Total costs = \$320,710
 No. of F.A.O.'s = 185

Placement of Farm Advisory Officers
(Policy 4 - Restricted Set of Office Locations)

NORTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 1</u>			
Auckland	4	Waitemata	4.0
Whangarei	7	Bay of Islands Whangarei	0.3 6.7
Dargaville	2	Hobson Otamatea	1.4 0.6
Kaikohe	2	Whangaroa Sth Hokianga Bay of Islands	0.3 0.4 1.3
Kaitaia	2	Mangonui Whangaroa Nth Hokianga	1.4 0.1 0.5
Pukekohe	6	Franklin	6.0
Warkworth	4	Otomatea Rodney	1.1 2.9
<u>Region 2</u>			
Hamilton	6	Nth Raglan* Sth Raglan Sth Waikato Waipa	1.3 1.3 2.0 1.4
Rotorua	2	Rotorua	2.0
Te Kuiti	4	Otorohanga Waitomo	1.9 2.1
Matamata	5	Matamata	5.0
Morrinsville	6	Nth Waikato Hauraki Plains Ohinemuri Piako	1.7 0.5 0.2 3.6
Taumarunui	2	Taumarunui	2.0
Taupo	1	Taupo	1.0
Tauranga	5	Ohinemuri Tauranga	0.4 4.6
Te Awamutu	2	Waipa	2.0
Thames	2	Coromandel Thames Hauraki Plains	0.6 0.5 0.9
Whakatane	3	Whakatane Opotiki	2.4 0.6
<u>Region 3</u>			
Hastings	4	Nth Hawkes Bay Sth Hawkes Bay	2.0 2.0
Gisborne	5	Waikohu Nth Cook Sth Cook	0.9 3.0 1.1

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Dannevirke	7	Waipawa	1.0
		Waipukurau	0.5
		Patangata	1.3
		Dannevirke	3.0
		Woodville	0.7
		Akitio	0.5
Masterton	8	Eketahuna	0.7
		Masterton	1.6
		Wairarapa Sth.	4.1
		Featherston	1.6
Ruatoria	1	Waiapu	1.0
Wairoa	1	Wairoa	1.0
<u>Region 4</u>			
Palmerston North	10	Pahiatua*	0.9
		Kiwitea	1.2
		Pohangina	0.7
		Oroua	1.6
		Manawatu	3.2
		Kairanga	1.2
		Horowhenua	1.2
New Plymouth	7	Clifton	0.9
		Taranaki	3.0
		Inglewood	1.2
		Stratford	1.9
Wanganui	7	Waimarino	0.7
		Waitotora	1.1
		Wanganui	1.0
		Nth Rangitikei	2.4
		Sth Rangitikei	1.8
Hawera	5	Egmont/Waimate West	2.1
		Stratford	0.2
		Eltham/Hawera	1.8
		Patea	0.9
Levin	1	Horowhenua	0.3
		Hutt	0.7

North Island Totals

Office costs = \$70,501
Travel costs = \$118,178
Total costs = \$188,679
No. of F.A.O.'s 121

SOUTH ISLAND

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
Nelson	3	Waimea 1	2.3
		Waimea 2	0.7
Motueka	2	Waimea 2	1.3
		Golden Bay	0.7
Westport	2	Buller	1.7
		Inangahua	0.3
Greymouth	2	Grey	1.0
		Westland	1.0
Blenheim	4	Awatere	1.5
		Marlborough	1.9
		Kaikoura	0.6

Office	No. of F.A.O.'s	County	No. of F.A.O.'s
<u>Region 6</u>			
Rangiora	6	Amuri	1.2
		Cheviot	1.2
		Waipara	0.8
		Ashley	0.6
		Rangiora	0.2
		Oxford	0.4
		Paparua etc	1.6
Christchurch	5	Rangiora	0.4
		Eyre	3.0
		Malvern	1.6
Akaroa	1	Akaroa	0.7
		Wairewa	0.3
Ashburton	5	Ellesmere	1.9
		Ashburton	3.1
Fairlie	1	MacKenzie	1.0
Timaru	3	Geraldine	1.4
		Levels	1.6
Waimate	2	Waimate	2.0
<u>Region 7</u>			
Oamaru	3	Waitaki 1	1.5
		Waitaki 2	1.5
Palmerston	2	Waihemo	1.4
		Maniototo	0.6
Dunedin	3	Waikouaiti	1.7
		Taieri	1.3
Alexandra	2	Vincent	0.9
		Lake	0.4
		Tuapeka	0.7
Balculutha	5	Bruce	2.8
		Tuapeka	0.5
		Clutha	1.7
<u>Region 8</u>			
Invercargill	7	Southland 1	7.0
Gore	6	Southland 2	2.8
		Wallace 1	2.3
		Wallace 2	0.9

South Island Totals

Office costs = \$36,955
Travel costs = \$82,954
Total costs = \$119,909
No. of F.A.O.'s = 64

New Zealand Totals

Office costs = \$107,456
Travel costs = \$201,132
Total costs = \$308,588
No. of F.A.O.'s = 185

RECENT PUBLICATIONS

RESEARCH REPORTS

48. *Proceedings of an N.Z. Seminar on Project Evaluation in Agriculture and Related Fields*, R. C. Jensen (ed.), 1968.
49. *Inter-Industry Structure of the New Zealand Economy, 1961-5*, B. J. Ross and B. P. Philpott, 1968.
50. *Fresh Vegetable Retailing in New Zealand*, G. W. Kitson, 1968.
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