A Study of the Distribution of Fresh Fish in the United Kingdom

Prepared by B.R.S. Consultancy Service

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A STUDY OF THE DISTRIBUTION OF FRESH FISH IN THE UNITED KINGDOM ON BEHALF OF THE SEA FISH INDUSTRY AUTHORITY

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NOTE ON CONTENTS

The report gives summarised results of an investigation into the road distribution arrangements within the United Kingdom and includes computer simulations of different future options. An explanation of the operation of the main computer simulation (the "Pathfinder") is given in the report.

As a back-up to the report, a single copy of a complete printout of a single computer programme run has been supplied by the Consultants. It defines a national consumption and delivery requirement schedule for the whole of England and Wales, in a series of 10km squares. The grid pattern contains up to 66 squares in the N-S and up to 53 in the E-W direction.

The print out comprises several hundred pages of A3 size paper and it is impractical to produce copies with this report. A sample segment, with a short explanation, is provided as the final appendix of this report.

CONTENTS

1. INTRODUCTION

The Sea Fish Authority (SFIA) was formed as a result of the combination and rationalisation of the Herring Board and the White Fish Authority. The SFIA presides over an industry which has been in decline in most areas over recent years. Consumer demand for fresh fish has been declining. Fishing fleets have reduced significantly, particularly the deep water fleets. The number of specialist fish mongers has reduced and fish friers have diversified into other products with their chips to meet competition from other fast food competition such as hamburger" joints" or the ethnic food take away. It is thought that there is a whole generation of younger people who do not even know how to cook fresh fish.

Among the few encouraging trends recently has been the inclusion of fresh fish into the big food supermarket chains. This trend has been assisted by developments in packaging such as controlled atmosphere packaging (CAP) which eliminates the "mess" usually associated with fresh food products. CAP can also extend the life of the product by 2 or 3 days as long as temperate controls are rigorously controlled.

Temperature control in this product is vital. Fresh fish has a life from catch of 20 days if the temperature is maintained in a range of 0 - 2 °C. Freezing produces a different product. Heating produces rapid deterioration. The quality of the final product is highly dependent on the time and temperature conditions encountered between landing and consumption.

Consideration of the above points led the SFIA to concentrate on a marketing approach to promote recovery of the industry through increased consumer sales supported by increased quality. A key component in any marketing plan concerns distribution, particularly important in this case since it is in the distribution chain that the quality of the product is most at risk.

As a component of the marketing plan for fresh fish, BRS Consultancy were asked to consider alternative distribution strategies and the costs to the industry associated with such plans. The BRS Consultancy was ideally placed to undertake such a study, having considerable experience of the distribution industry as a whole and of fish distribution in particular through the BRS Ltd involvement in fish distribution on behalf of the Grimsby Fish Merchants Association.

The terms of reference that were generated for the project are reproduced in Appendix I. During the course of the project and through discussion with SFIA the nature of the terms of reference were modified slightly. These modifications are reflected in the body of the report.

2. PROJECT OUTLINE

This section of the report details the steps taken to complete the project. Each of the the steps outlined here are described in detail within the main body of the report.

For the purposes of distribution planning it is necessary to know where the product is coming from and where it is going to. Government statistics provided information about "where from" with additional information provided by the Fishery Economics Research Unit particularly in respect of imports and inter port movements.

Fish consumption was derived by commercial television area based upon tables supplied by the Fishery Economics Research unit which were based on field analysis by Attwood Statistics Ltd. Further geographic detail on consumer demand was made by using the BRS PATHFINDER distribution planning model's population database. This permits the spread of distribution demand for a given area according to the population spread in the area.

Having defined the distribution problem in terms of the physical movements from source to destination, the next stage was to investigate present operations. It was advised that the main distribution systems operated out of East Scotland (through Charles Alexander & Partners Transport Ltd), Brixham (through Lawrence Rae Ltd) and Grimsby (through Grimsby Fish Merchants Association). Each of these systems is described.

In order to prove reasonable distribution plans it is necessary to know not only the weight being transported to given destinations but also the number of deliveries that a given weight represents. This data was not available in any of the official statistics. The figures supplied by reference to previous analysis by the Industrial Development Unit of the SFIA (for Alexanders and Lawrence & Rae) and by direct observation and sampling (for GFMA). During this phase of the project visits were made to the Port of Grimsby and Billingsgate Fish Market and a GFMA depot.

Having defined the demand placed upon any distribution system the BRS Distribution planning model - PATHFINDER was used to calculate the numbers of vehicles required to deliver the demand for different strategic options. The options described in more detail later in this report are:

Option 1	A notional present day operation - ie an attempt to reflect the present resources used in fresh fish distribution.
Option 2	Assess the effect of combining Grimsby and the South

West into a single system based on the existing Grimsby configuration .

Option 3 — Assess the effect of combining Grimsby, the South West and Scotland into a single system based on the existing Grimsby configuration.

Option 4 — Assess the resources for distributing the total demand through a depot infrastructure based on the fish markets.

Option 5 — As Option 2, but assuming that customers are common to Grimsby and the South West.

Option 6 — As Option 3 but assuming that customers are common to Grimsby, the South West, and East Scotland.

Option 7 — As Option 4 but assuming that customers are common for all product sources.

For the distribution options analysed above, the trunking model was used to calculate the resources necessary to trunk the product in bulk to the secondary distribution points.

The report is concluded by costings on the above options, discussion of other considerations affecting quality and our conclusions.

3. FISH MOVEMENTS

3.1 Landings

Details of fish landings by port are given in the MAFF Sea Fisheries Table. All figures relate to 1981 which was the latest full year available at the time of the analysis.

The tables deal with whole fish tonnages landed. Of more concern was the tonnage which found its way into the fresh fish distribution system for human consumption. In order to achieve this a number of assumptions were made as follows:

Assumption 1

1. Landings on the Scottish Islands have been apportioned 33% transfer to Aberdeen for processing, the remainder being used for other purposes

2. Only Demersal species have been included as representing those fish eventually distributed through the fish delivery system.

3. The total weight of imports is proportioned to the imported weight of the four main species.

4. The transported weight is 50% of the landed weight.

5. Only Humberside (Hull & Grimsby) and Aberdeen provide significant volumes of fillets for freezing.

6. The final total fish input to the distribution system is equal to the demand identified for fresh fish consumption.

The following table shows the build up of the figures incorporating the above assumptions.

It can be seen from the table that main supplies are Aberdeen and Humberside, these ports accounting for half the total input.

	WHITBY AND N. SHIELD	SCARBORO	HULL BRIDL'TON	GRIMSBY	L'STOFT YARM'TH	BRIXHAM PLYMOUTH NEWLYN	MILFORD HAVEN	FLEETWOOD	W'HAVEN	OTHER PORTS	ABERDEEN P'HEAD	ULLAPOOL	AYR	OTHER SCOTTISH	TOTAL
Total landings of Demersal Fish ex British Vessels (Table 4 MAFF Statistics 1981)	17,006	5,363	12,650	40,646	18,272	9,932	2,913	11,730	1,200	15,908	135,331 +3,800[1]	13,370	8,535	49,709 -11,460[1]	342,565
Total landings of Demersal Fish ex Foreign Vessels (Table 5 MAFF Statistics 1981)			8,975	26,645	12,404			3,093		307					56,573
IMPORTS. FRESH OR CHILLED WHOLE FISH (FERU)[2]			20,594	26,645	12,404			4,181		18,099	136				82,059
INTERPORT MOVEMENTS (Movements of whole fish to another port for Processing) (IDU)			10,104[3]	10,104[3]				3,093		307	-23,608				0
SUB TOTALS	17,006	5,363	52,323	121,288	30,676	9,932	2,913	21,696	1,200		115,659	13,370	8,535	38,249	473,537
ESTIMATE OF TONNAGE FED INTO FISH DISTRIBUTION SYSTEM (ie exclude processing loss & frozen supply)[4]	8,503	2,681	15,638*	36,250*	15,338	4,966	1,456	10,848	600	17,663	34,568*	6,685	4,267	19,124	178,588

Note 1. Adjustment for Scottish Islands landings. 33% assumed as wholefish transfer to Aberdeen.

Note 2. Based on an extrpolation from the figures for four main species according to MAFF Statistics for those species by port.

Note 3. The movement from Aberdeen to Humberside was assumed to be split 50% to Hull, 50% to Grimsby.

Note 4. Assumes 50% weight loss in the processing. Figures marked * have been further adjusted downwards to take account of supply to frozen food producers.

For further analysis of the distribution systems that might deliver the requirements described above, it was assumed that demand could be classified into four present distribution systems.

These are:

Aberdeen	Mainly through Charles Alexander
Grimsby	Mainly through GFMA
Brixham and Milford	Mainly through Lawrence & Rae
Other Ports	Through ad hoc distribution systems

In considering distribution systems, the tonnage fed into a such a system is modified by three factors'

1. Local port sales which avoid movement through any formal distribution chain.

2. The effect of Billingsgate Market in London which attempts to occupy a monopoly trading position in the South East. Movements to Billingsgate are considered as trunking movements later.

3. Scottish consumer demand is satisfied from Scottish ports only.

The following table summaries the inputs to the distribution system (in tons/annum) according to the above categories.

	Brixham and Milford	Grimsby	Others	N. East Scottish	Total
Inputs from Table 1	6,422	36,250	71,271	64,644	178,587
less Scottish Demand				28,181	28,181
less Local Port Dist:	1,605	-	35,635	14,585	51,825
Amount to be Distributed into England and Wales	4,817	36,250	35,636	21,878	98,581

3.2 Fish Consumption

The Fisheries Economic Research unit produces statistics of demand by commercial television region. The tables are based on market research by Attwood Statistics Ltd, conducted quarterly and produced as a consumer panel report. These results relate to 1982 and are shown in the following table:

TV Area	Household Consumption	Caterer Consumption	Total	% of Total
Scottish	14,184	13,997	28,181	15.8
Yorkshire	14,520	14,329	28,849	16.2
Lancashire	12,208	12,047	24,255	13.6
Midlands	15,707	15,500	31,207	17.5
Harlech West	7,578	7,478	15,056	8.4
Southern	7,931	7,827	15,758	8.8
London	17,758	17,524	35,282	19.8
	89,886	88,702	178,588	100

It has been assumed in the compilation of this table that consumption of fish through catering establishments is apportional to TV region in the same ratio as household consumption, since the FERU tables apply only to household consumption.

Appendix 2 shows a map of the Television areas.

4. EXISTING DISTRIBUTION SYSTEM

4.1 General

There are no dedicated fish distribution schemes where it can be guaranteed that all fish will be distributed through the system. There are however situations where a single carrier has built up significant volumes of business so that a dedicated system almost applies. These such systems are described here and became the basis for further analysis in later sections of this report. Each of the carriers involved is described in this section. Note that none of the carriers has a monopoly of the trade which it carries and is subject to competition from other carriers offering a similar and reduced level of service as far as number of delivery locations is concerned.

4.2 Charles Alexander - Aberdeen

Charles Alexnader and Partners Transport Ltd operate a fish distribution system out of Aberdeen serving the North East Scottish ports.

As a general principle Charles Alexander works on supplying trunk routes to the main markets with a lesser dependence on secondary distribution through a depot network.

The main trunk routes are:

Aberdeen - London	Mainly to Billingsgate.
- Newcastle	For secondary distribution through Tyne & Wear from the Newcastle depot.
- Glasgow /Edinburgh	Mainly market deliveries with some distribution from the Glasgow depot.
- Humberside	This route is mainly bulk fish for processing.
- Birmingham	Servicing Birmingham market and the CA Bilston depot while delivering to West Midlands, East Midlands and South Wales.
- Haydock	A CA depot serving the North West. The trunk trailer will do direct deliveries to Manchester and Liverpool markets

4.2 Grimsby Fish Merchants Association

GFMA have operated a transport scheme for 16 years. The distribution is very much retail oriented and grew as a road transport operation following the Beeching Report and its effect on the railways.

Insulated trunk trailers are stand loaded at the port. Any merchant who has consignments to send can deliver them to the trailer. The trunks run each day at scheduled times to a number of British Road Services depots. (The full list of GFMA trunking destinations is shown in Appendix 3). At the depot the load is transhipped to distribution vehicles, (usually 7 ton flat vehciles) for local delivery including deliveries to the market.

There is a not the same emphasis on markets in the GFMA system, a market being a delivery point just the same as any other. For this reason GFMA is vulnerable to competition who cream the larger delivery work (mainly to markets), leaving GFMA with the more costly small deliveries.

4.3 Lawrence & Rae

The Lawrence & Rae operation works out of Brixham with depots at Gloucester and Stoke on Trent. The type of operation is similar to Charles Alexander with the emphasis on trunking routes rather than secondary distribution to retail customers.

In addition to the South West source (Brixham, Plymouth, Newlyn etc) fish from Milford Haven is trunked into Gloucester to be consolidated with other deliveries.

5. DELIVERY SIZE

In order to be able to predict the number of vehicles required for distribution, and therefore the costs, it is necessary to know the number of deliveries that are represented by a given tonnage of fish. This information was not available in any published statistics and had to be obtained by sampling.

The main sampler was taken from GFMA consignments. The data for Charles Alexander and Lawrence & Rae was supplied from recent work conducted by the Industrial Development Unit of the Sea Fish Industry Authority. The GFMA sample was taken at Dunstable. In all some 1,845 deliveries were anaylysed over a period from 25.10.82 - 17.12.82. Full details of the sample are recorded in Appendix 4.

In summary from the results were:

Carrier	Average Delivery Size
Charles Alexander	214 lb
GFMA	168 lb
Lawrence & Rae	247 lb

Note that the GFMA figure includes all deliveries since the Grimsby distribution is predominantly retail orientated. The other two results are for the retail delivery only and exclude the deliveries to markets, most of which are undertaken on the trunker. Hence the above delivery size relates to retail deliveries only. ie those deliveries made by secondary distribution vehicles following trans shipment from a trunker.

6. RESULTS OF THE DISTRIBUTION PLANNING MODEL

6.1 Introduction

It is this section which contains the main bulk of the analytical results most of which were produced using the BRS PATHFINDER distribution planning model. A general description of PATHFINDER is shown in Appendix 5.

In this case the method used has been standard across all the options that have been analysed. The first step has been to spread the demand across the area to be analysed according to the population. The PATHFINDER population data base contains information on the population per 10 Km ordnance survey grid squares. Using this data base and defining the delivery area in terms of 10Km grid aquares the demand was spread across the squares to produce the tonnage and the number of deliveries for each 10Km grid square. PATHFINDER then scheduled vehicles from the depot to satisfy the demand. An example of a PATHFINDER print out is shown in Appendix 6.

Several parameters have to be predefined to obtain good vehicle schedules. In all the PATHFINDER analysis that follows the following parameters have been used for secondary distribution.

1.	Distribution Speeds	30, 25, 20, 15, 12 mph
2.	Trunking Speeds	35, 30, 25, 20, 15 mph
3.	Motorway Speeds	45 mph
4.	Delivery Time	5 minutes per delivery plus 180 minutes per ton of commodity

The following results are based on an average week. Detailed output statistics from the PATHFINDER runs can be found in Appendix 12

6.2 The "NOW" Situation

The now situation represents a notional view of the resources currently employed on secondary distribution. The situation is notional because assumption has been made in order to achieve a result. It is that;

All fish other than that delivered by the three carriers described above is distributed on vehicles from the markets as though it were a formal distribution system.

In order to achieve this result, from separate distribution systems for Aberdeen, Grimsby, Brixham and the remainder are scheduled separately and totalled. The results are as follows

	TONS	DROPS	MILES	VEHICLES
GFMA	539	7194	40009	108
S.W. Depot	56	511	15198	22
Scottish Depots	55	625	7142	13
Billingsgate	546	3694	29967	83
Other Markets & Dist. Centres	643	7870	39455	112
Local Port Deliveries	716	8248	37354	117
Total (exc Ports)	1839	19894	131771	338
Total (incl. Ports)	2555	28142	169125	455

6.3 Option 2

Option 2 computes the effect on vehicle resources assuming that the distributions from Grimsby and the South West were combined, with the new distribution based on the Grimsby depots. It has been assumed in this option that both distributions have separate customers and that the total number of deliveries is the same as the "NOW" situation. The results are as follows:

	TONS	DROPS	MILES	VEHICLES
GFMA Depots	595	7689	43221	115
S.W. Depots	-	-	-	-
Scottish Depots	55	625	7142	13
Billingsgate	546	29967	29925	83
Other Markets & Dist. Centres	643	7870	39455	112
Local Port Deliveries	716	8248	37354	117
Total (excl. Ports)	1839	19878	119785	323
Total (incl.Ports)	2555	28126	157139	440

6.4 Option 3

Option 3 computes the effect on vehicle resources assuming that the distribution from Grimsby, the South West and Scotland were combined; with the new distribution system based on the Grimsby depots. The same assumptions apply as for Option 2. The results are as follows:

	TONS	DROPS	MILES	VEHICLES
GFMA Depots	650	8314	49338	124
S.W. Depots	-	-	-	-
Scottish Depots	-	-	-	-
Billingsgate	546	3694	29967	83
Other Markets & Dist. Centres	643	7870	39455	112
Local Port Deliveries	716	8248	37354	117
Total (excl. Ports)	1839	19878	118760	319
Total (incl. Ports)	2555	28126	156114	446

6.5 Option 4

The Grimsby, South West and Scottish distribution systems are combinmed with the system based on markets and distribution centres. The same assumptions apply as for Option 2. The results are as follows"

	TONS	DROPS	MILES	VEHICLES
GFMA Depot	-	-	-	-
S.W. Depots	-	-	-	-
Scottish Depots	-	-	-	-
Billingsgate	508	3436	23441	73
Other Markets & Dist. Centres	1331	16003	77433	219
Local Port Deliveries	716	8248	37354	117
Total (excl. Ports)	1839	19439	100874	292
Total (incl Ports)	2555	276872	138228	409

6.6 Option 5

As Option 2, but assuming that customers are common to Grimsby and South West. The results are as follows:

	TONS	DROPS	MILES	VEHICLES
GFMA Depots	595	7498	42698	114
S.W. Depot	-	-	-	-
Scottish Depots	55	625	7142	13
Billingsgate	546	3694	29967	83
Other Markets & Dist. Centres	643	7870	39455	112
Local Port Deliveries	716	8248	37354	117
Total (excl. Ports)	1839	19687	119262	322
Total (incl. Ports)	2555	27935	156616	439

6.7 Option 6

As Option 3 but assuming that customers are common to Grimsby, the South West and East Scotland. The results are as follows:

	TONS	DROPS	MILES	VEHICLES
GFMA Depots	650	7870	45047	120
S.W. Depot	-	-	-	-
Scottish Depots	-	-	-	-
Billingsgate	546	3694	29967	83
Other Markets & Dist. Centres	643	7870	39455	112
Local Port Deliveries	716	8248	37354	117
Total (excl. Ports)	1839	19434	114469	315
Total (incl. Ports)	2555	27682	151823	432

6.8 Option 7

as Option 4 but assuming what customers are common for all product sources. The results are as follows:

	TONS	DROPS	MILES	VEHICLES
GFMA Depots	-	-	-	-
S.W Depots	-	-	-	-
Scottish Depots	-	-	-	-
Billingsgate	508	3436	23441	73
Other Markets & Dist. Centres	1332	8117	56069	179
Local Port Deliveries	716	8248	37354	117
Total (excl. Pots)	1840	11553	79510	252
Total (incl. Ports)	2556	19801	116864	369

7. TRUNKING RESOURCES

7.1 Introduction

This section contains details of the resources required to transport the product from source to the depot systems described in Section 6.

The following should be noted:

1) Trunking to Billingsgate is constant for all the options (1 - 7) described in Section 6, except for Options 4 and 7 where the tonnage is slightly reduced, but the mileage and vehicle resources remain the same.

2 The trunk routes from Grimsby are based on the routes currently run by GFMA. (Grimsby Fish Merchants Association).

3. Trunk routes which exceed the permitted driving hours for one driver are covered by vehicles based at an intermediate point on the trunk. ie one driver collects from the source, another driver delivers to the secondary distribution depots. Alternatively a changeover halfway is used.

4. Trunk vehicles are assumed to operate from Grimsby with one driver unless other wise stated.(Appendices 8, 9, 10)

5. A trunk vehicle consists of tractor unit plus trailer

Section 7 consists of the following parts:

7.2 Trunking for Option 1

7.3 Trunking for Option 2 or Option 5

7.4 Trunking for Option 3 or Option 6

7.5 Trunking for Option 4 or Option 7

Details for the above trunking can be found in Appendices 7 - 11.

7.2

TRUNKING FOR OPTION 1

	FROM	TO	TRUNKERS	DRIVERS WEEK	MILES/
1.	Grimsby	GFMA Depts	10	13	16525
	South West	Gloucester	1	1	1530
	Scotland	CA Depots*	4	5	6280
2.	Grimsby/S.W./ Scotland	B'gate	10	12	15500
3.	Elesewhere	Markets & Dist. Centres	15	19	24074
			40	50	63909

1. Details in Appendix 8.

2. Details in Appendix 7.

3. Details in Appendix 11 (a)

7.3

TRUNKING FOR OPTION 2 OR OPTION 5

	FROM	TO	TRUNKERS	DRIVERS	MILES/ WEEK
..(	Grimsby	GFMA Depots	10	13	16525
1.(	South West	Glos/GFMA	3	4	5355
(	Scotland	CA			
(		Depots*	4	5	6280
2.	Grimsby/S.W. Scotland	B'gate	10	12	15500
3.	Elsewhere	Markets & Dist. Centres	15	19	24074
			42	53	67734

1. Details in Appendix 9

2. Details in Appendix 7

3. Details in Appendix 11(a)

7.4

TRUNKING FOR OPTION 3 OR OPTION 6

	FROM	TO	TRUNKERS	DRIVERS	MILES/ WEEK
1.	Grimsby	GFMA Depots	11	14	16935
	South West	Glos/GFMA	3	4	5355
	Scotland	GFMA	2	3	3700
2.	Grimsby/S.W. Scotland	B'gate	10	12	15500
3.	Elsewhere	Markets & Dist. Centres	15	19	24074
			41	52	65564

1. Details in Appendix 10

2. Details in Appendix 7

3. Details in Apprndix 11 (a)

7.5

TRUNKING FOR OPTION 4 OR OPTION 7

	FROM	TO	TRUNKERS	DRIVERS	MILES/ WEEK
1.	All Ports	Markets & Dist. Centres	31	39	49870
2.	Grimsby/S.W/ Scotland	B'gate	10	12	15500
			41	51	65370

1. Details in Appendix 11 (b)

2. Details in Appendix 7

8. RESOURCES AND COSTS

8.1 Introduction

In this section the resources required to operate each of the 7 options are totalled in 8.2 and costs calculated in 8.3.

The costs are based on the following assumptions:

1) Distributuon vehicle is a 7.37 ton G.V.W. rigid with a maximum capacity of 3.5 tons.

Standing charge per annum	=	£2549 per vehicle
Running costs	=	17p per mile
Driver costs per annum	=	£8840 per driver

2) Trunking vehicle consists of a 32 ton G.V.W. tractor unit and a 40 ft tandem trailer with a maximum capcity of 20 tons.

Standing charge per annum	=	£7673 per tractor unit
Standing charge per annum	=	£3530 per trailer
Running costs	=	13.5p per mile
Driver cost per annum	=	£9360 per driver

8.2

NOT - COMMON DROPS

Option 1

455 x 7 ton	@	18585 m.p.a.	+	455 drivers
40 x Artics	@	79886 m.p.a.	+	50 drivers

Option 2

440 x 7 ton	@	17857 m.p.a.	+	440 drivers
42 x Artics	@	80636 m.p.a.	+	53 drivers

Option 3

436 x 7 ton	@	17903 m.p.a.	+	436 driver
41 x Artics	@	79956 m.p.a.	+	52 drivers

Option 4

409 x 7 ton	@	16898 m.p.a.	+	409 drivers
41 x Artics	@	79719 m.p.a.	+	51 drivers

COMMON DROPS

Option 5

439 x 7 ton	@	17838 m.p.a.	+	439 drivers
42 x Artics	@	80636 m.p.a.	+	53 drivers

Option 6

432 x 7 ton	@	17572 m.p.a.	+	432 drivers
41 x Artics	@	79956 m.p.a.	+	52 drivers

Option 7

369 x 7 ton	@	15835 m.p.a.	+	369 drivers
41 x Artics	@	79719 m.p.a.	+	51 drivers

8.3 Costs per Annum

NOT COMMON DROPS

	STANDING	RUNNING	DRIVERS	TOTAL
Option 1	£	£	£	£
455 x 7 ton	1,159,795	1,437,549	4,022,220	6,619,544
40 x Artics	306,920	431,384	468,000	1,206,304
40 x Trailers	141,200	-	-	141,200
				7,967,048
Option 2				
440 x 7 ton	1,121,560	1,335,704	3,889,600	6,346,864
42 x Artics	332,2	457,206	496,080	1,275,552
42 x Trailers	148,260	-	-	148,260
				7,770,676
Option 3				
436 x 7 ton	1,11,364	1,326,970	3,854,240	6,292,574
41 x Artics	314,593	442,556	486,720	1,243,869
41 x Trailers	144,730	-	-	144,730
				7,681,173
Option 4				
409 x 7 ton	1,042,541	1,174,918	3,615,560	5,833,019
41 x Artics	314,593	441,245	477,360	1,233,198
41 x Trailers	144,730	-	-	144,730
				7,210,947

COMMON DROPS

	STANDING	RUNNING	DRIVERS	TOTAL
Option 5	£	£	£	£
439 x 7 ton	1,119,011	1,331,250	3,880,760	6,331,021
42 x Artics	322,266	457,206	496,080	1,275,552
42 x Trailers	148,260	-	-	148,260
				7,754,833
Option 6				
432 x 7 ton	1,101168	1,290,488	3,818,880	6,210,536
41 x Artics	314,593	442,556	486,720	1,243,869
41 x Trailers	144,730	-	-	144,730
				7,599,135
Option 7				
369 x 7 ton	940,581	993,329	3,261.960	5,195,870
41 x Artics	314,593	441,245	477,360	1,233,198
41 x Trailers	144,730	-	-	144,730
				6,573,798

EXCLUSIONS

The terms of reference and the quotation do not allow for any market research on the likely effects of improved quality and availability of fish on its demand pattern. It has been assumed that the SFIA can provide guidance on these matters.

APPENDIX 1

TERMS OF REFERENCE

1. To design a range of distribution systems for the nationally coordinated movement of fish to meet various selected service levels.

   Service in this context encompasses not merely transit time but also the quality of handling throughout the distribution chain with particular reference to temperature control.

2. To cost the system designed in order to define the cost/service function.

3. Each system would be examined and costed at present and two forecast demand levels to provide the cost/service profile at various throughput levels. The two forecasts could represent the extremes of the pessimistic and optimistic view of demand.

CONDUCT OF THE STUDY

The work plan for the study would cover the following phases:

1. Establishment of the volume of fish currently distributed. Information is available from SFIA records broken down to commercial television areas.

2. Establishment of the customer profile and drop size. This would require a sample from the actual orders. The GFMA data would form the basis of this but correlation of the data with other ports would be necessary.

3. The generation of a demand pattern fro UK deliveries using the BRS Consultancy distribution model.

4. Discussion with SFIA on:

   4.1 the limits of acceptable distribution system design variations to be included.

   4.2 the levels of throughput to represent an optimistic and pessimistic forecast.

5. An examination of the present UK infrastructure for temperature controlled warehousing.

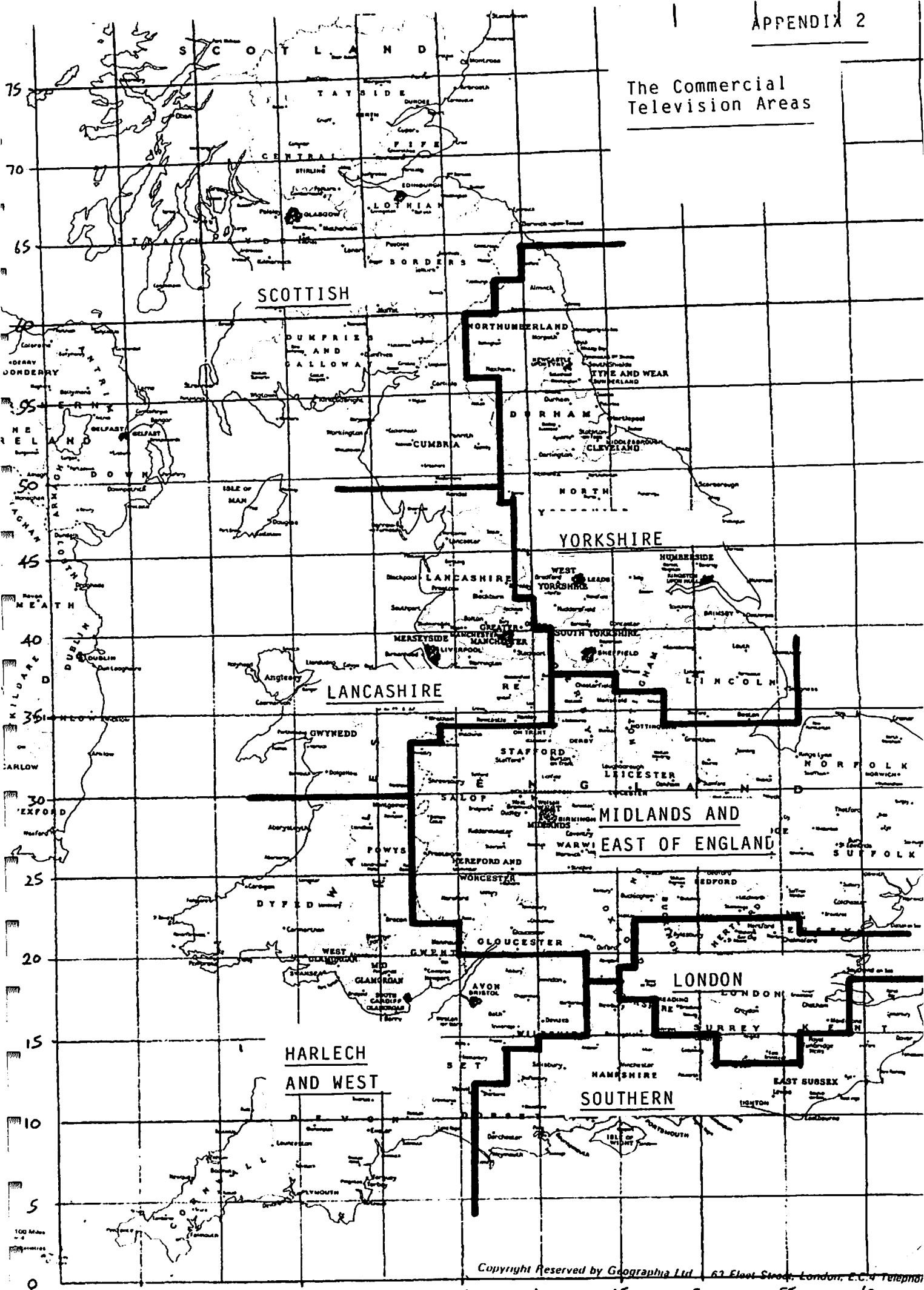
6. The calculation of the resources required for each of the distribution systems considered.

7. The costing of each system.

8. Documentation of the results and the presentation of a report.

APPENDIX 2

The Commercial Television Areas



APPENDIX 3

THE GFMA RUNKING DISTRIBUTIONS

The Grimsby system operates regular trunks to the following destinations

- Sheffield
- Leeds
- Kendal
- Manchester
- Stoke-on-Trent
- Wrexham
- Exeter
- Bridgwater
- Bristol
- Cardiff
- Poole
- Gloucester
- Oxford
- Birmingham
- Birmingham
- Dunstable
- Wisbech
- Bury St Edmunds
- Norwich
- Brentford
- Mid Kent
- Southampton

G.F.M.A. DUNSTABLE TRAFFIC

	Route 797				Route 798				Route 799				Total			
		Weight				Weight				Weight				Weight		
Date	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs
29.11.82	23	26	3	19	11	20	1	15	13	35	1	5	47	82	2	11
30.11.82.	13	13	2	19	13	18	0	24	9	16	3	11	35	48	2	26
1.12.82.	26	24	0	10	21	34	2	15	27	26	2	18	74	85	1	17
2.12.82.	16	21	3	11	17	26	3	4	22	38	3	9	55	87	1	24
3.12.82.	13	14	0	26	16	20	2	1	12	14	2	2	41	49	1	1
6.12.82	22	29	1	19	9	18	1	26	17	24	0	20	48	72	0	9
7.12.82.	19	19	1	23	17	20	0	20	11	21	2	14	47	61	1	1
8.12.82	13	14	0	3	12	20	1	12	16	18	7	9	41	52	2	24
29.12.82.	14	20	3	0	15	26	2	1	15	35	2	24	44	82	2	25
10.12.82.	11	14	0	6	16	21	2	10	11	14	1	17	38	50	0	5
13.12.82.	16	25	3	3	12	21	0	1	13	15	3	18	41	62	2	22
14.12.82.	12	9	0	27	11	17	2	17	12	17	1	24	40	44	1	12
15.12.82.	16	14	1	4	13	28	3	2	18	20	3	0	47	63	3	6
16.12.82.	17	27	0	17	22	27	1	11	19	36	1	7	58	90	3	7
17.12.82.	11	11	0	21	11	18	0	25	14	22	0	10	36	51	2	0
													1845	2453	62	516

G.F.M.A. Dunstable Traffic

Average weight per drop	1 cwt 0 qrs 14 lbs	Route 797
Average weight per drop	1 cwt 2 qrs 20 lbs	Route 798
Average weight per drop	1 cwt 2 qrs 10 lbs	Route 799
Average number of drops per day	16.35	Route 797
Average number of drops per day	14.18	Route 798
Average number of drops per day	14.00	Route 799
Average load per day	18 cwt 1 qr 24 lbs	Route 797
Average load per day	21 cwt 3 qrs 7 lbs	Route 798
Average load per day	22 cwt 1 qrs 4 lbs	Route 799

APPENDIX 4

The Whole of the Sample Data Used to determine GFMA Drop Size

GFMA DUNSTABLE TRAFFIC

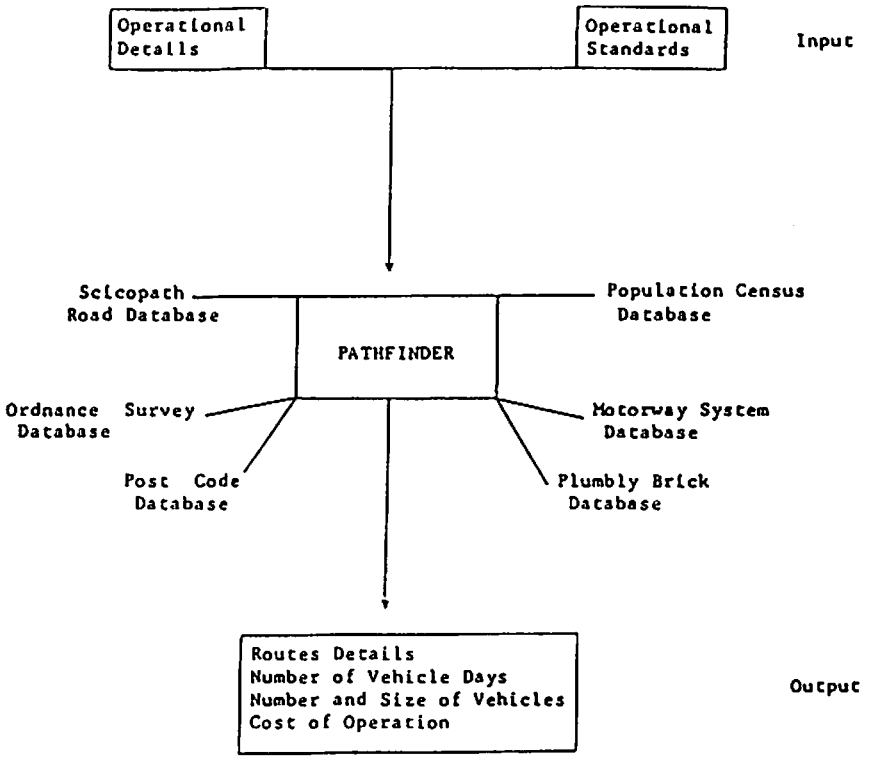
Date	Route 797 Weight				Route 798 Weight				Route 799 Weight				Total			
	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs	Drops	Cwt	Qr	lbs
25.10.82.	20	27	2	2	13	21	1	13	19	28	1	17	52	69	1	4
26.10.82.	21	17	2	18	20	24	2	21	17	25	2	6	58	67	3	17
27.10.82	21	22	1	26	13	20	1	17	19	20	3	23	53	63	3	0
28.10.8.	19	27	2	12	18	32	1	4	19	29	0	0	53	89	0	8
29.10.82.	16	17	0	3	18	21	1	26	16	20	3	16	50	58	1	21
1.11.82.	20	23	0	6	10	15	3	24	14	23	1	24	44	62	1	26
2.11.82.	13	12	2	20	13	21	0	23	12	18	1	21	38	52	1	10
3.11.82.	19	17	0	23	16	20	2	7	20	27	1	3	55	65	2	5
4.11.82.	17	21	2	20	16	23	3	2	19	27	1	7	52	72	3	1
5.11.82.	13	16	1	25	13	21	1	4	15	18	2	10	41	48	1	8
8.11.82	19	25	3	1	15	22	2	11	17	22	0	12	51	64	1	24
9.11.82.	17	14	0	2	11	13	3	7	12	19	0	22	40	47	0	3
10.11.82.	16	17	0	9	14	17	2	10	18	21	1	12	48	52	0	3
11.11.82	14	19	3	24	14	25	0	10	14	21	3	15	42	62	0	1
12.11.82.	11	9	3	1	15	18	3	6	12	13	1	18	38	43	3	25
15.11.82.	16	18	2	2	14	22	1	27	13	18	1	20	43	59	1	20
16.11.82.	15	11	2	11	15	16	3	15	12	14	6	21	42	42	2	19
17.11.82.	16	16	1	18	12	18	1	21	14	20	2	27	42	55	2	10
18.11.82.	17	23	1	8	16	22	3	25	17	25	3	10	50	72	0	15
19.11.82.	12	10	1	16	15	21	1	4	10	15	0	17	37	40	3	11
22.11.82.	16	18	1	23	12	16	0	23	11	19	0	22	39	53	3	12
23.11.82.	19	13	1	25	14	17	2	24	14	19	1	18	47	49	2	11
24.11.82.	18	22	3	14	17	28	2	15	20	15	1	23	55	66	3	24
25.11.82.	13	19	0	11	16	25	1	4	17	34	0	11	46	78	1	26
26.11.82.	14	15	0	25	13	21	1	26	10	11	3	27	37	48	2	22
													1153	1475	35	326

APPENDIX 5

PATHFINDER

WHAT IS PATHFINDER?

BRS Pathfinder is a Distribution Analysis Model which utilises a number of support databases to enable a wide variety of potential applications. A brief schematic showing these elements is given below.



BRS Pathfinder owes its origins as a strategic planning tool to the early 1970's when it was designed to assist in the efficient operation of the BRS Distribution activity.

Since that time it has evolved on two fronts - internally in the design of a wide range of distribution systems and externally through the work of BRS Consultancy Service in solving various problems in a number of different industries.

Throughout all of these applications, the emphasis with Pathfinder is that it produces practical solutions. The advantage of close development within a transport company is that solutions are very soon tested and accountability is high.

Throughout the years, Pathfinder has been continually developed to maintain and increase the confidence of operational managers within BRS and the remainder of industry.

Some projects in which Pathfinder has been used are:

1. A nationwide study for one of the 'big six' brewers to provide options for running separately their home sales fleet. This involved systematically varying depot location, delivery areas and operating standards.

2. A nationwide study for a tailoring chain in which a single depot (North of England) location was compared to a regional stockholding system of four depots. Variations were also made in the frequency of deliveries per week to assess the effect on fleet size.

3. An investigation of the distribution activity of a major food producer in the London area. Pathfinder was used to produce a comparison between nominated day and random deliveries from each of two potential depot locations.

4. A study into the distribution of cigarettes and tobacco products in the North West of England. This study was to determine whether the operation was best served from one depot in Manchester or also from a second depot in Liverpool.

5. A study for a High Street durables chain into whether, given vehicle access restrictions on some branches economies could be made by using articulated vehicles and 40' trailers rather than smaller distribution vans.

6. A study for a major brewer into the rationalisation of their distribution operation in the South East from seven small depots into two strategically located depots. This study made direct use of the brewer's sales data in a Plumbly Brick form.

How does Pathfinder work?

Pathfinder is sufficiently flexible to allow its use to solve a full range of problems. The precise way in which it is used depends on:

i) the amount of available information concerning the user's operation.

ii) the level of accuracy required of the solution.

For instance, Pathfinder may be in a situation where the only available information is total throughput and average drop size. This is often the case where a new product is introduced into a large area having been test marketed in a different area.

In such a case, Pathfinder Datahandler is used which calls into service the Population Census Database. The model then spreads throughput and drops in standard Ordnance Survey Grid squares across the delivery area according to one of four different population characteristics. Pathfinder itself then consideres this as input to the model.

Used in this way, Pathfinder is a very fast and inexpensive method of strategic planning, particularly, as there is very little time involved in data collection and preparation.

At the other extreme, a lot of information may be available concerning the user's operation and he may require a detailed examination. In this case, Pathfinder is able to use details of each individual customer such as: drop size, order frequency, early closing times, delivery problems, vehicle access problems etc.

Used in this way, the output details each individual customer on the routes created by the model.

In between these two extremes there are a number of ways in which Pathfinder may be used. For instance, if it is known that 6 tons per week of a product is delivered in 35 drops in Leicester then that information may be input for that individual grid square without needing to know about each of the thirty-five drops.

The Model Components

Pathfinder	The central core of the model which assesses the level of work, produces routes, allocates routes to vehicles, schedules vehicles and costs the operation.
Datahandler	Spreads the work within the delivery area according to the population distribution within the area.
Population Census	Used by Datahandler and contains, for every Ordnance Survey 10 kilometre grid square in Britain: Male population, Female population, Total population and number of Households.
Ordnance Survey Database	Contains details of each 10 kilometre grid square in Britain. Information held is land occupancy and ease of travel through that square. The latter is used in conjunction with user-defined speed parameters.
Scicopath Road Database	A database of 6,500 road junctions and 20,000 road links covering British roads down to B road level.
Motorway System Database	The British motorway system called in to supplement the simple Pathfinder distance calculation when Scicopath is not being used
Plumbly Brick Database	A database containing the proportion of plumbly bricks falling within each 10 kilometre grid square in Britain. This facilitates a quick and inexpensive conversion of a widely used management tool.
Postal Code Database	A database containing the Ordnance Survey grid reference of Postal Districts in Britain.

What can Pathfinder do?

Whilst Pathfinder may be used at a very simple level with only basic operational details it is possible to carry out detailed investigations by examining and varying over eighty different control parameters.

Examples of some of these parameters is given below along with some of the details output by the model.

Input Parameters

Depot location, number and size of drops
Number and size of collections
Distribution speeds, Trucking speeds
Vehicle size, Shift times, Multi-day trips
Utilisation levels, Fixed and variable delivery times, Length of working week, Length of working year, Number of trips in a day, Turnaround time in a depot, Vehicle costings, Driver costs, Early closing time, Vehicle access problems, Order frequency.

Output Details

Total throughput and number of drops and collections, Total mileage, Total time, Individual route details, Schedules of vehicles, Total standing charge, Total running costs, Total overnight costs **Number of vehicles of each specified size.**

APPENDIX 6

AN EXAMPLE OF A PATHFINDER PRINTOUT

The following printout shows the results of a sample PATHFINDER run. This particular run shows the delivery pattern generated for the Option 6 (i.e. Grimsby + South West + Scottish) deliveries to the area serviced from Sheffield depot.

All the results apply to an average week and show tonnages, number of calls, miles travelled and time for each route run during the week

SHEFFIELD AREA
OPTION 6
GFMA + SW + SCOT

```
@XQT P*F.DATARUN
                BRSL PATHFINDER DATAHANDLER
                ===========================
                DESIGNED BY BRITISH ROAD SERVICES CONSULTANCY SERVICE

     ARE YOU USING INDIVIDUAL CUSTOMER DATA?
     SUPPLY FILE NAME FOR DATA
     HOW MANY RECORDS HAVE BEEN WRITTEN ON FILE?
     DO YOU WISH TO INPUT DATA TO THE FILE,
     SPECIFY AREA INFORMATION
     INFORMATION ON   34 INPUTS FOUND.
     TOTAL SQUARES IN THE AREA    38
     NO. OF CALLS     296 , QUANTITY OF GOODS      25.07
     FILE FOR FLEET SIZING MODEL COMPLETE
     PROGRAM END

@XQT P*F.RUN
                BRS  PATHFINDER
                ===============
                LOCAL DISTRIBUTION ANALYSIS MODEL
                =================================
                DESIGNED BY BRITISH ROAD SERVICES CONSULTANCY SERVICE
                THIS VERSION RELEASED NOVEMBER 1981

     DATE : 15/ 9/83     TIME : 17:22:54

          ENTER DATA NOW
     OPTS 0,0,0,0,1,1,30
     DEPO 43.6,38.6
     DSPD 30,25,20,15,12
     TSPD 35,30,25,20,15
     VEHS 1,0,3,5
     DELI 5,180
     TIME 8,8,8
     2DAY 500,1
     LIEU
     MWAY 45
     SCAL 1,1.5
     SHED 1,3,8,1,1
     MAPS
     STOP
```

DATA SUMMARY

1. GRID SIZE SPECIFICATION

THE LENGTH OF A SQUARE IS 6.214 MILES
THE NUMBER OF SQUARES IS 9 X 6

2. DEPOT LOCATION

(43.60 , 38.80) WHERE (40.00, 42.00) IS THE NORTH-WEST CORNER

3. TIME RESTRICTIONS

THE MAXIMUM TIME AVAILABLE FOR DISTRIBUTION IS	8.00 HOURS
THE MAXIMUM TIME FROM FIRST TO LAST CALL IS	8.00 HOURS
THE MAXIMUM TIME FROM START TO LAST CALL IS	8.00 HOURS
THE MAXIMUM DRIVING TIME AVAILABLE IS	8.00 HOURS

4. UTILISATIONS

THE VEHICLE LOAD UTILISATION SOUGHT IS 85. PERCENT
THE VEHICLE TIME UTILISATION SOUGHT IS 85. PERCENT OF A SHIFT

5. TRIPS OF MORE THAN ONE DAY

THE MINIMUM MILEAGE PRIOR TO CONSIDERING ANOTHER SHIFT IS 500.0
THE TIME DEDUCTED FROM SUBSEQUENT SHIFTS IS 1.00 HOURS

6. UNLOADING TIMES

THE FIXED TIME PER DELIVERY IS 5.00 MINUTES
THE VARIABLE TIME IS 180.00 MINUTES PER UNIT OF COMMODITY

7. FLEET SPECIFICATION

NUMBER	VEHICLE SIZE
***	3.50

*** MEANS AN UNLIMITED NUMBER

8. SPEEDS

SPEED	1	2	3	4	5
DISTRIBUTION	30.0	25.0	20.0	15.0	12.0
TRUNK	35.0	30.0	25.0	20.0	15.0
MOTORWAY	45.0				

9. BARRIERS

NO BARRIERS STATED

10. WORK GENERATION

SCALING FACTORS FOR CONVERTING INPUT DATA TO PROBLEM DATA

QUANTITY OF DELIVERY GOODS FACTOR IS 1.000

NUMBER OF DELIVERY CALLS FACTOR IS 1.000

NUMBER OF DAYS DATA BEING USED 5

11. VEHICLE SCHEDULING

SCHEDULING OPTION 1 IN FORCE

5 DAYS WORK TO BE SCHEDULED

8.00 HOURS WORKED IN A SHIFT

1.00 HOURS TURNAROUND TIME IN DEPOT

1.00 HOURS LEFT IN A SHIFT TO WARRANT NIGHT OUT

KEY TO FIGURES IN GRID OF INPUT DATA

IN EACH SQUARE FIGURES REFER TO :

NUMBER OF DELIVERY CALLS
QUANTITY OF GOODS TO BE DELIVERED
DISTRIBUTION SPEED RATING
TRUNKING SPEED RATING
LAND RATING

	1	2	3	4	5	6	7
1							5
							.40
							1
	1	5	2	3	1	1	2
							1
2		3	3	24	13	19	9
		.23	.27	2.04	1.12	1.63	.82
		1	2	4	2	4	3
	1	1	1	4	1	4	2
		1	1	1	1	1	1
3			3	25	26	8	5
			.23	2.11	2.24	.66	.40
			2	3	4	2	2
	2	1	2	2	3	2	2
			1	1	1	1	1
4		1	2	62	15	7	2
		.06	.14	5.26	1.32	.61	.15
		1	1	5	1	2	1
	2	1	1	5	1	1	1
		1	1	1	1	1	1
5		1	1	15	9	6	1
		.07	.08	1.25	.77	.54	.07
		1	1	4	2	4	1
	2	1	1	4	2	3	1
		1	1	1	1	1	1
6						18	3
						1.56	.23
						4	2
	1	1	2	2	1	3	2
						1	1

KEY TO FIGURES IN GRID OF PROBLEM DATA

IN EACH SQUARE FIGURES REFER TO :

SCALED NUMBER OF DELIVERY CALLS
SCALED QUANTITY OF GOODS TO BE DELIVERED
TIME (IN HOURS) TO COMPLETE WORK IN SQUARE

	1	2	3	4	5	6	7
1							5 .40 1.34
2		3 .23 1.06	3 .27 1.22	24 2.04 9.29	13 1.12 4.94	19 1.63 7.51	9 .32 3.70
3			3 .23 1.11	25 2.11 9.33	26 2.24 10.11	8 .66 3.01	5 .40 1.39
4		1 .06 .27	2 .14 .68	62 5.26 23.16	15 1.32 5.68	7 .61 2.76	2 .15 .59
5		1 .07 .29	1 .06 .33	15 1.25 5.91	9 .77 3.47	6 .54 2.61	1 .07 .37
6						18 1.56 7.20	3 .23 1.25

INPUT DATA SUMMARY
==================

TOTAL GOODS TO BE DELIVERED	25.0
TOTAL DELIVERIES TO BE MADE	295
NO. OF SQUARES CONTAINING WORK	33

ROUTE STATISTICS

NO.	TIME	GOODS	MILES	CALLS	(I,J)		
1	7.9	1.1	99.0	13	(47,39)	(47,40)	(47,41
2	7.7	1.0	109.4	12	(46,37)	(47,37)	(48,35
3	7.8	1.2	72.0	13	(45,36)	(45,36)	
4	8.0	1.2	68.0	14	(45,40)	(46,40)	
5	7.7	1.2	63.5	14	(45,37)	(45,36)	
6	7.8	1.3	58.9	15	(45,39)	(45,40)	
7	8.0	1.3	77.1	16	(44,40)	(45,39)	(45,35
8	7.8	1.3	67.5	15	(43,40)	(42,40)	(41,40
9	8.0	1.3	63.1	16	(42,38)	(41,38)	(41,37
10	7.8	1.4	51.1	16	(44,38)	(44,37)	(43,37
11	7.8	1.4	39.9	17	(43,40)		
12	7.8	1.4	54.0	16	(44,39)	(44,40)	(43,40
13	7.9	1.6	32.1	18	(44,39)		
14	7.9	1.5	46.0	18	(44,38)	(44,39)	(43,39
15	7.9	1.6	26.4	20	(43,39)		
16	7.8	1.6	19.7	18	(43,38)		
17	8.0	1.6	20.2	19	(43,38)		
18	8.0	1.6	20.2	19	(43,38)		
19	2.9	.5	12.1	6	(43,38)		

TOTALS

GOODS	=	25.0
MILES	=	1000.2
DROPS	=	295
TIME	=	144.5
ROUTES	=	19

VEHICLE SCHEDULES METHOD 1

VEHICLE CLASS	VEHICLE NO.	ROUTE NUMBERS						TOTAL TIME	UTIL. (%)
1	1	18 /	17 /	9 /	7 /	4 /		40.0	99.91
1	2	13 /	1 /	14 /	15 /	12 /		39.4	98.56
1	3	10 /	8 /	3 /	6 /	11 /		39.1	97.63
1	4	16 /	5 /	2 /	19 /			26.1	65.24

APPENDIX 7

TRUNKING TO BILLINGSGATE

Ex Grimsby (2 trunks/night)

each: 16.7 tons, 360 miles

Ex South West Ports (1 trunk/night)

7.4 tons, 420 miles (2 drivers + 2 vehicles c/o London)

Ex Scottish Ports (2 trunks/night)

each: 14.1 tons, 980 miles (4 drivers)

(Drivers based Aberdeen, Newcastle, London)
3 vehicles using changeovers

APPENDIX 8

EX GRIMSBY

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
1.	Birmingham	9.4	260	
	Nottingham	5.2		
2.	Mid-Kent	7.8	420	(2 drivers)
	Dunstable	2.8		Lincoln
3.	Leeds	4.8	443	(2 drivers
	Manchester	4.0		(+ 2 vehicles
	Kendal	0.6		c/ Lancaster)
	Wrexham	1.8		
	Sheffield	4.2		
4.	Leeds	8.0	264	
	Manchester	8.0		
	Stoke	1.8		
5.	Norwich	1.4	279	
	Bury St Edmunds	3.2		
	Wisbech	1.6		
6.	Bristol	4.8	524	(2 drivers)
	Cardiff	7.4		Banbury
	Oxford	1.4		
7.	Gloucester	1.6	584	(2 drivers)
	Bridgwater	1.0		(+2 vehicles
	Exeter	4.8		c/o Exeter
8.	Southampton	10.2	531	(2 drivers)
	Brentford	6.8		Northamptom
	Poole	2.6		

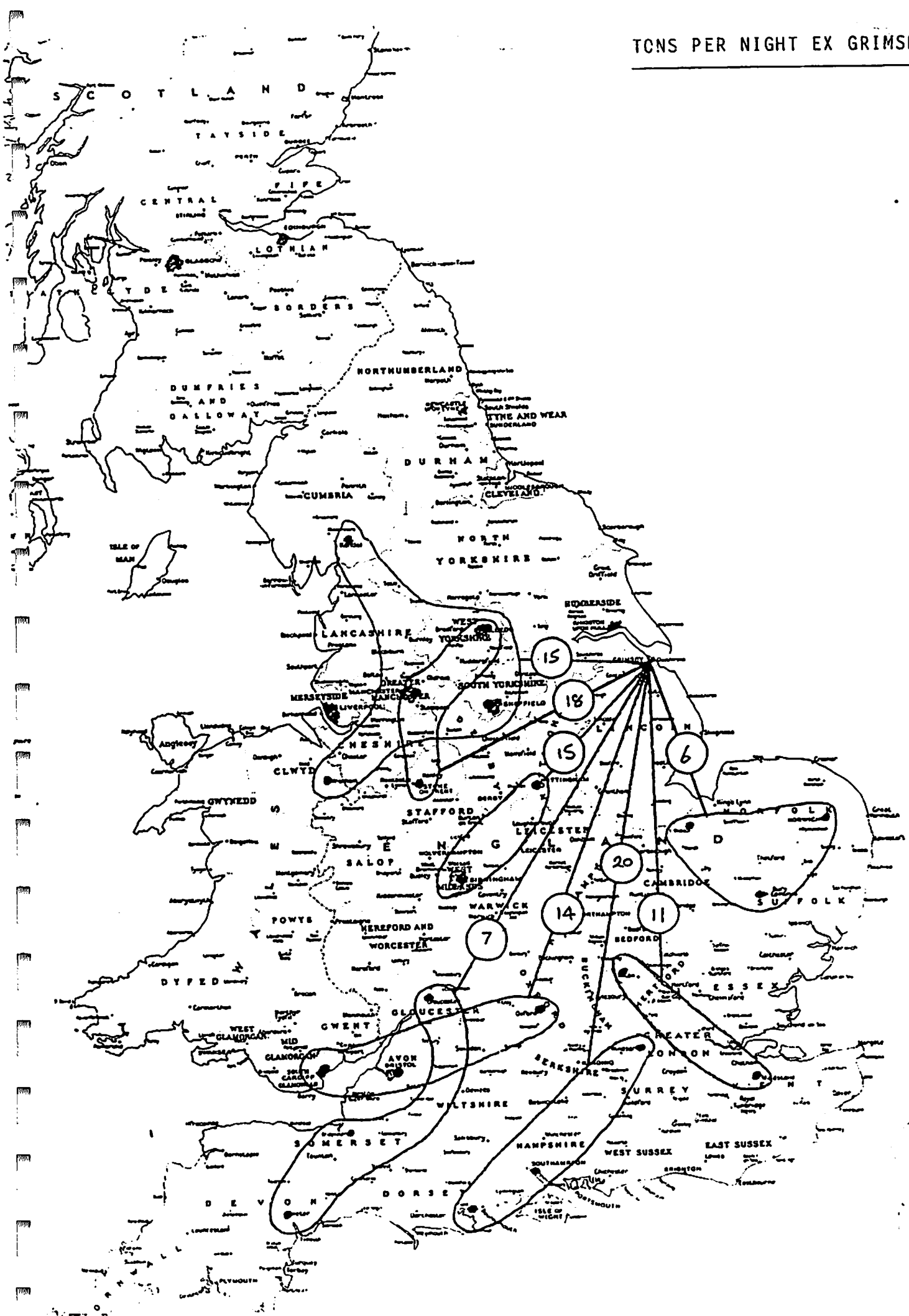
EX SOUTH WEST PORTS

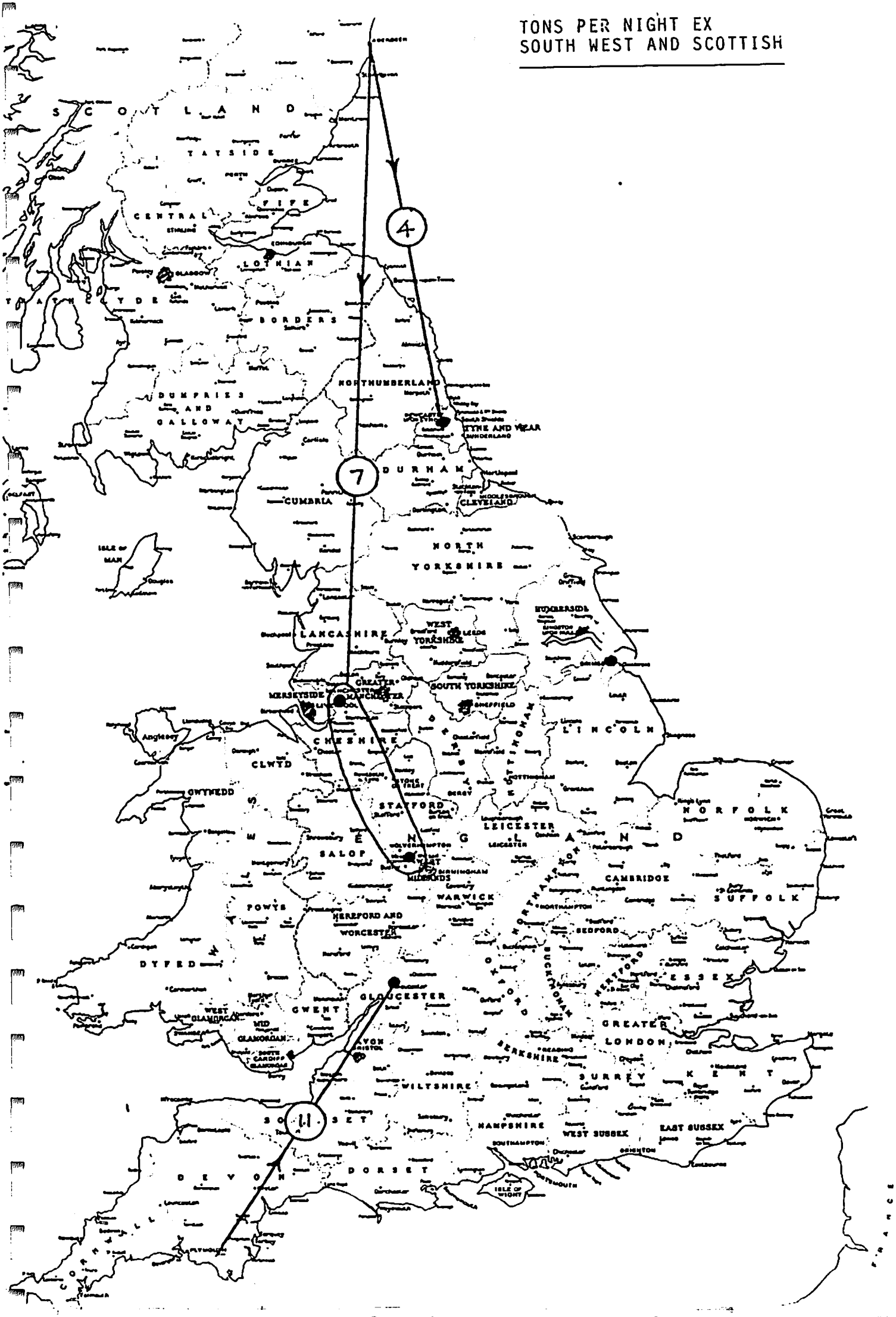
ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
9.	Gloucester	11.2	306	Gloucester

EX SCOTTISH PORTS

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
10.	Newcastle	4.2	440	(2 drivers) 2 vehicles) c/o N'castle
11.	Haydock Bilston	3.4 3.4	816	(3 drivers) + 2 vehicles) c/o Preston

TONS PER NIGHT EX GRIMSBY




TONS PER NIGHT EX
SOUTH WEST AND SCOTTISH
4
7
11
SCOTLAND
TAYSIDE
FIFE
CENTRAL
LOTHIAN
BORDERS
DUMFRIES AND GALLOWAY
NORTHUMBERLAND
TYNE AND WEAR
DURHAM
CUMBRIA
CLEVELAND
NORTH YORKSHIRE
HUMBERSIDE
WEST YORKSHIRE
LANCASHIRE
SOUTH YORKSHIRE
MERSEYSIDE
GREATER MANCHESTER
CHESHIRE
LINCOLN
NOTTINGHAM
CLWYD
GWYNEDD
STAFFORD
LEICESTER
NORFOLK
SALOP
WEST MIDLANDS
CAMBRIDGE
SUFFOLK
POWYS
WARWICK
HEREFORD AND WORCESTER
BEDFORD
NORTHAMPTON
DYFED
GLOUCESTER
ESSEX
GWENT
GREATER LONDON
BERKSHIRE
WILTSHIRE
SURREY
KENT
SOMERSET
HAMPSHIRE
WEST SUSSEX
EAST SUSSEX
DEVON
DORSET
ISLE OF WIGHT
ISLE OF MAN

APPENDIX 9

EX GRIMSBY

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
1.	Birmingham Nottingham	10.8 6.0	260	
2.	Mid-Kent Dunstable	8.6 3.2	420	(2 drivers) Lincoln
3.	Leeds Manchester Kendal Wrexham Sheffield	4.8 6.0 0.6 2.0 4.2	443	(2 drivers) (+ 2 vehicles) c/o Lancaster
4.	Leeds Manchester Stoke	8.0 8.0 2.0	264	
5.	Norwich Bury St Edmunds Wisbech	1.4 3.6 1.8	279	
6.	Bristol Cardiff Oxford	4.8 1.4	524	(2 drivers) Banbury
7.	Gloucester Bridgwater Exeter	1.6 1.0 4.8	584	(2 drivers) (+ 2 vehicles) c/o Exeter
8.	Southampton Brentford Poole	10.2 6.8 2.6	531	(2drivers) Northampton

EX SOUTH WEST PORTS

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOTS
9	Gloucester	11.2	306	Gloucester

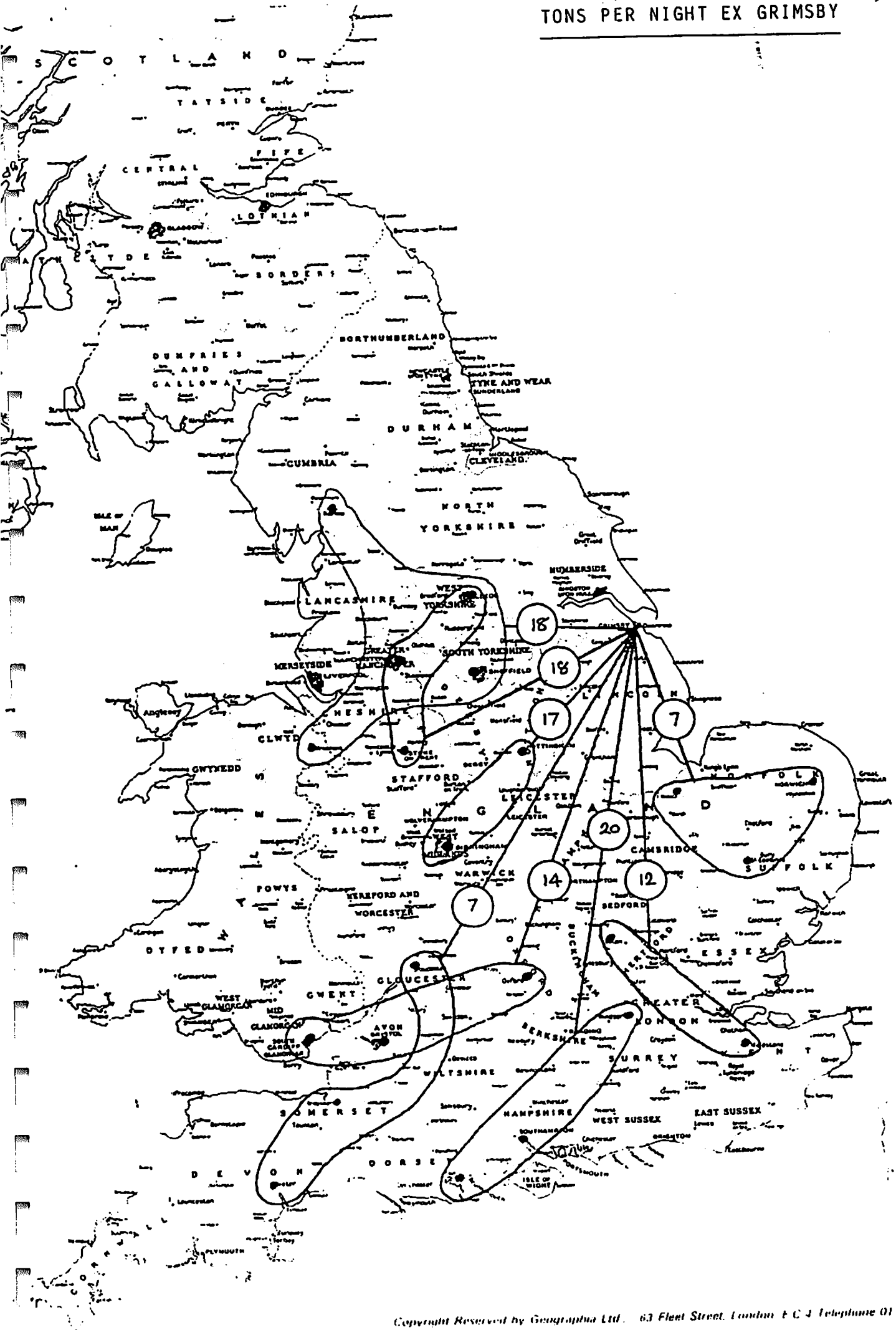
EX GLOUCESTER

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
10.	Grimsby	6.0	360	Gloucester
11.	Cardiff	1.0	406	(2 drivers)
	Bristol	0.6		Exeter
	Bridgwater	0.2		
	Exeter	1.2		
	Poole	0.4		
	Southampton	1.4		
	Oxford	0.2		

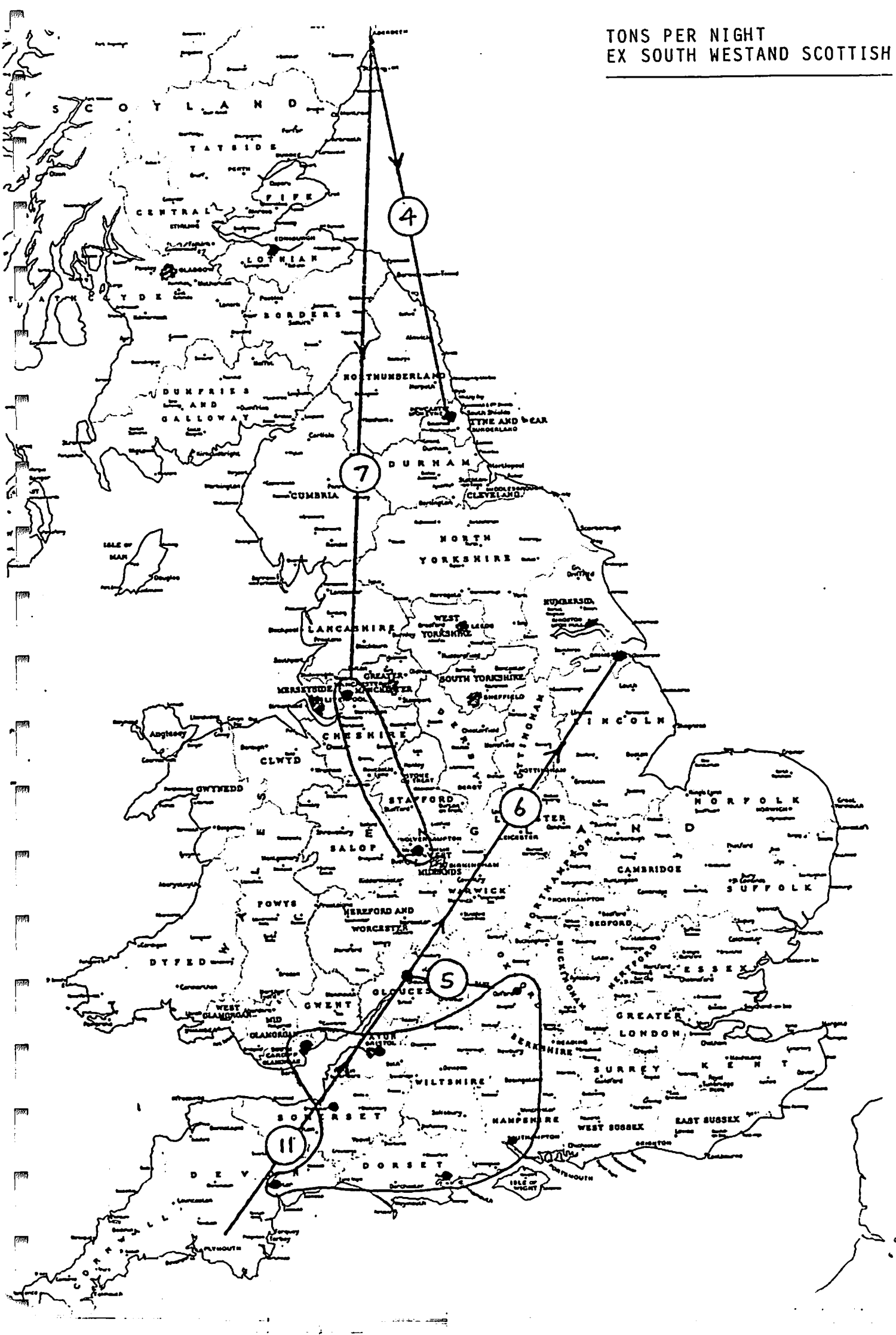
EX SCOTTISH PORTS

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
12	Newcastle	4.2	440	(2 drivers + 2 vehicles c/o N'castle
13.	Haydock	3.4	816	(3 drivers)
	Bilston	3.4		2 vheicles) c/o Preston

TONS PER NIGHT EX GRIMSBY



TONS PER NIGHT
EX SOUTH WESTAND SCOTTISH



APPENDIX 10

EX GRIMSBY

ROUTE	DEPOTS SERVICED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOTS
1.	Birmingham	12.4	260	
	Nottingham	7.0		
2.	Mid-Kent	8.6	420	(2 drivers)
	Dunstable	3.2		Lincoln
3.	Leeds	15.6	142	
4.	Manchester	16.2	259	
	Stoke	2.4		
5.	Kendal	0.8	388	(2 drivers
	Wrexham	2.6		+ 2 vehicles)
	Sheffield	5.0		c/o Lincoln
6.	Norwich	1.4	279	
	Bury St Edmunds	3.6		
	Wisbech	1.8		
7.	Bristol	4.8	524	(2 drivers)
	Cardiff	7.4		Banbury
	Oxford	1.4		
8.	Gloucester	1.6	584	(2 drivers)
	Bridgwater	1.0		+ 2 vehicles)
	Exeter	4.8		c/o Exeter
9.	Southampton	10.2	531	(2 drivers)
	Brentford	6.8		Northampton
	Poole	2.6		

EX SOUTH WEST PORTS

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
10.	Gloucester	11.2	306	Gloucester

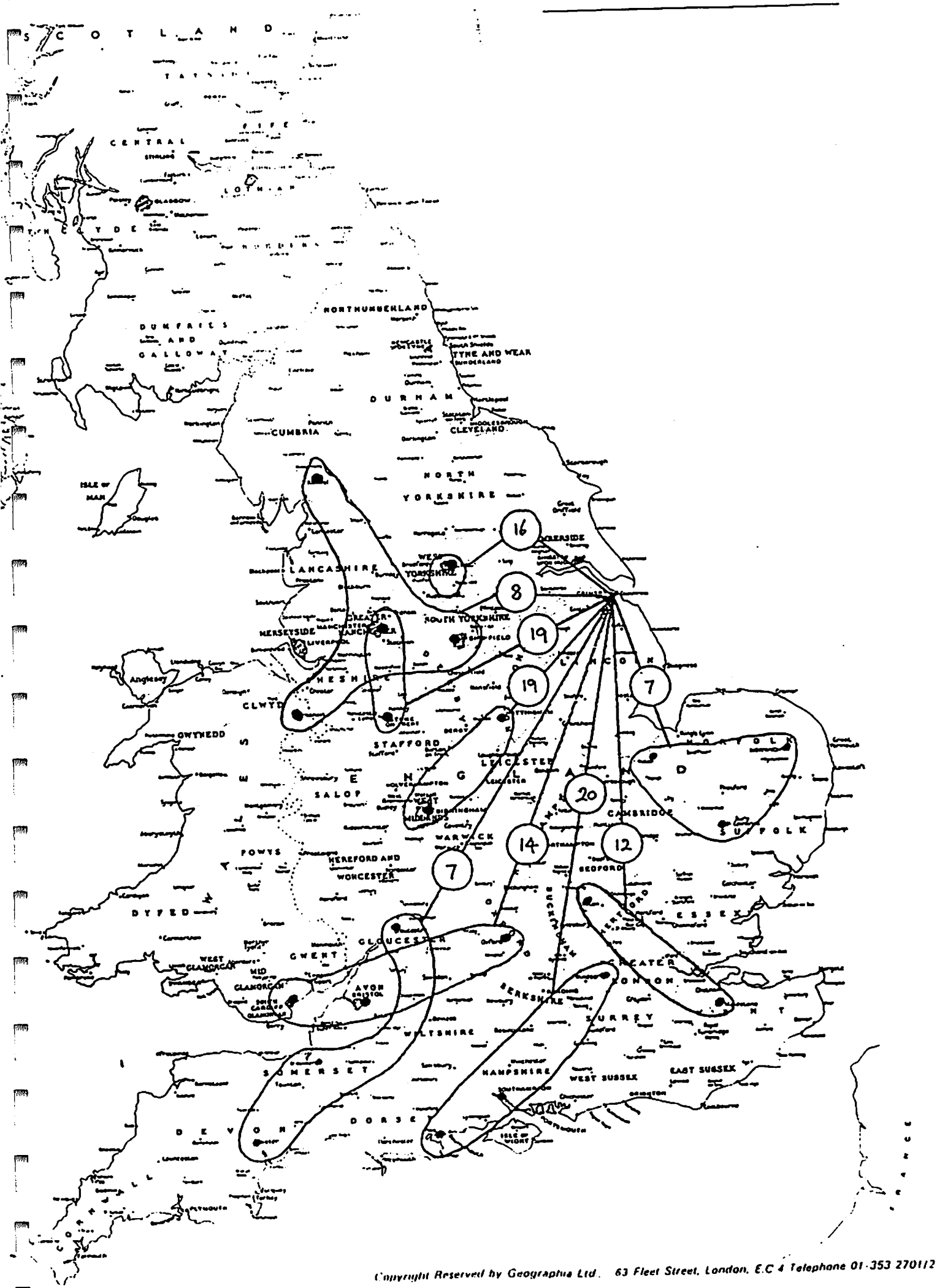
EX GLOUCESTER

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
11.	Grimsby	6.0	360	Gloucester
12.	Cardiff	1.0	405	(2 drivers) Exeter
	Bristol	0.6		
	Bridgwater	0.6		
	Exeter	1.2		
	Poole	0.4		
	Southampton	1.4		
	Oxford	0.2		

EX SCOTTISH PORTS

ROUTE	DEPOTS SERVED	TONS/NIGHT	MILES/NIGHT	OPERATIONAL DEPOT
13.	Grimsby	11.0	740	(3 drivers + 2 vehicles) c/o N'castle

TONS PER NIGHT EX GRIMSBY



EXAPLANATION OF PATHFINDER PRINTOUT

The following explanation takes as its basis the Pathfinder output from the Sheffield run of option 6, which is the first printout in the computer binder and also the example in Appendix 6 of the report. However the following comments can also be applied to the other Pathfinder output.

NOTE: Paragraphs (III) to (XX) refer to the red numbers on the computer printout for the Sheffield area.

I) Prior to the Pathfinder run the total tonnage and drops in the Yorkshire TV area have been spread across the grid squares in the area according to population.

II) The Sheffield depot distribution area has been defined as shown on map 1.

III) The Datahandler program is used to "pull off" the drops and tonnage in the Yorkshire TV area that fall within the Sheffield distribution area.

IV) The Pathfinder program is then started and information is input concerning depot location, vehicle size etc.

V) A summary of the information is then given.

VI) The depot location for Sheffield is 43.6, 38.8.

VII) The length of a shift is restricted to 8 hours.

VIII) The model will accept a route which carries more than 85% of the maximum vehicle-capacity and which has run for more than 85% of a shift.

IX) If a route runs for more than 500 miles and carries less than 85% of a full load, but has exceeded 85% of a shift, the model will consider extending the route into a second shift. (Note: a high mileage such as 500 prevents routes of more than one shift, unless they are absolutely necessary).

XX) 5 minutes is added to the route time for each drop. A time of 180 minutes is also allowed for unloading each ton of fish.

XI) There is one type of vehicle with a capacity of 3.5 tons. The model may use any number of these vehicles to carry out the distribution.

XII) Each 10Km grid square throughout the country has a rating between 1 and 5 for distribution within the square and trunking through the square. Speeds are input and allocated to each rating.

There is also a motorway database which is used in conjunction with trunking and distribution speeds to calculate travelling times and distances.

XIII) There are no barriers (such as new estuaries) within the Sheffield area.

XIV) The drops and tons are to remain as they are and not to be scaled up or down. The model will work on the basis of a 5 day week.

XV) The routes will be scheduled over a week allowing 1 hour turnaround time between routes.

XVI) Two plans are printed showing certain information about each grid square in the area under consideration.

XVII) A Summary of the total tons and drops within the area is printed.

XVIII) The model now creates routes based on the demand data (tons and drops per grid square) and parameters explained above.

The output shows for each route:

Route No

Route time (in hours)

Goods carried (in tons)

Miles travelled

Calls made ie number of drops on route

10Km grid squares visited

XIX) Totals are printed which form the basis for the output statistics shown in Appendix 12 of the report.

XX) The routes are scheduled over a week to show the number of vehicles required (4 in this case).

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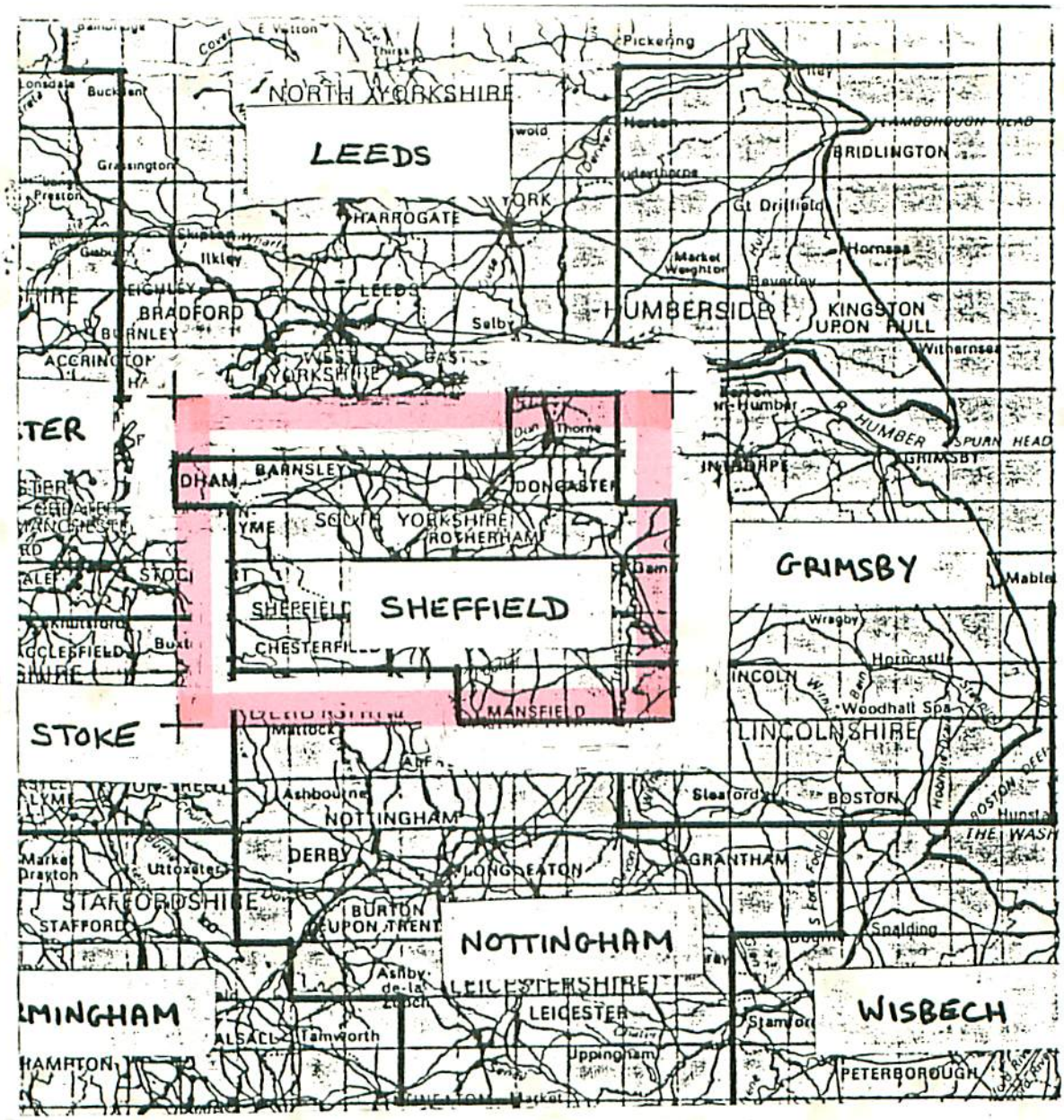
3.2.84.



NOTE: On computer print outs, the area references may be given in the form of MAIN GRID numbers (East, North) or by reference (East, South) to the square at the North-West corner of the rectangle which incorporates all grid squares in the region under review. Thus grid square 1,1 (Sheffield Area) is at position 40,42 on the map above and grid square 9,6 is at position 48,37.

MAP SHOWING SHEFFIELD DISTRIBUTION AREA

SHEFFIELD

```
$XQT P*F.DATARUN
          BRSL PATHFINDER DATAHANDLER
          ===========================
III).     DESIGNED BY BRITISH ROAD SERVICES CONSULTANCY SERVICE

ARE YOU USING INDIVIDUAL CUSTOMER DATA?
SUPPLY FILE NAME FOR DATA
HOW MANY RECORDS HAVE BEEN WRITTEN ON FILE?
DO YOU WISH TO INPUT DATA TO THE FILE,
SPECIFY AREA INFORMATION
INFORMATION ON:  34 INPUTS FOUND.
TOTAL SQUARES IN THE AREA   38
NO. OF CALLS     296 , QUANTITY OF GOODS      25.07
FILE FOR FLEET SIZING MODEL COMPLETE
PROGRAM END


$XQT P*F.RUN

          BRS  PATHFINDER
          ===============
          LOCAL DISTRIBUTION ANALYSIS MODEL
          =================================
          DESIGNED BY BRITISH ROAD SERVICES CONSULTANCY SERVICE
          THIS VERSION RELEASED NOVEMBER 1981

DATE : 15/ 9/83/     TIME : 17:22:54:

IV).  ENTER DATA NOW
OPTS  0,0,0,0,1,130
DEPO  43.6,38.8
DSPD  30,25,20,15,12
TSPD  35,30,25,20,15
VEHS  1,3,3.5
DELI  5,130
TIME  3,5,8
2DAY  50,1
FILE
MAY   45
SCAL  1,1,5
SHED  1,2,8,1,1
MAPS
STOP
```

v.)

DATA SUMMARY

1. GRID SIZE SPECIFICATION

THE LENGTH OF A SQUARE IS 6.214 MILES
THE NUMBER OF SQUARES IS 9 X 6

vi)

2. DEPOT LOCATION

(43.60, 38.80) WHERE (40.00, 42.00) IS THE NORTH-WEST CORNER

vii)

3. TIME RESTRICTIONS

THE MAXIMUM TIME AVAILABLE FOR DISTRIBUTION IS	8.00 HOURS
THE MAXIMUM TIME FROM FIRST TO LAST CALL IS	8.00 HOURS
THE MAXIMUM TIME FROM START TO LAST CALL IS	8.00 HOURS
THE MAXIMUM DRIVING TIME AVAILABLE IS	8.00 HOURS

viii).

4. UTILISATIONS

THE VEHICLE LOAD UTILISATION SOUGHT IS 85. PERCENT
THE VEHICLE TIME UTILISATION SOUGHT IS 85. PERCENT OF A SHIFT

5. TRIPS OF MORE THAN ONE DAY

ix). THE MINIMUM MILEAGE PRIOR TO CONSIDERING ANOTHER SHIFT IS 500.0
THE TIME DEDUCTED FROM SUBSEQUENT SHIFTS IS 1.00 HOURS

x)

6. UNLOADING TIMES

THE FIXED TIME PER DELIVERY IS 5.00 MINUTES
THE VARIABLE TIME IS 180.00 MINUTES PER UNIT OF COMMODITY

xi). 7. FLEET SPECIFICATION

NUMBER	VEHICLE SIZE
***	3.50

*** MEANS AN UNLIMITED NUMBER

xii). 8. SPEEDS

SPEED	1	2	3	4	5
DISTRIBUTION	30.0	25.0	20.0	15.0	12.0
TRUNK	35.0	30.0	25.0	20.0	15.0
MOTORWAY	45.0				

xiii). 9. BARRIERS

NO BARRIERS STATED

xiv) 10. WORK GENERATION

SCALING FACTORS FOR CONVERTING INPUT DATA TO PROBLEM DATA
QUANTITY OF DELIVERY GOODS FACTOR IS 1.000
NUMBER OF DELIVERY CALLS FACTOR IS 1.000
NUMBER OF DAYS DATA BEING USED 5

xv) 11. VEHICLE SCHEDULING

SCHEDULING OPTION 1 IN FORCE
5 DAYS WORK TO BE SCHEDULED
8.00 HOURS WORKED IN A SHIFT
1.00 HOURS TURNAROUND TIME IN DEPOT
1.00 HOURS LEFT IN A SHIFT TO WARRANT NIGHT OUT

	1	2	3	4	5	6	7	8	9
1	1	5	2	3	1	1	5 .40 1 2 1	1 .05 1 1 1	1
2	1	5 .23 1 1 1	3 .27 2 1 1	24 2.04 4 4 1	13 1.12 2 1 1	19 1.63 4 4 1	9 .82 3 2 1	1 .07 1 1 1	1
3	2	1	3 .23 2 2 1	25 2.11 3 2 1	26 2.24 4 3 1	6 .56 2 2 1	5 .40 2 2 1	1 .06 1 1 1	2
4	2	1 .06 1 1 1	2 .14 1 1 1	62 5.26 5 5 1	15 1.32 1 1 1	7 .61 2 1 1	2 .15 1 1 1	2 .19 2 1 1	1 .07 3 3 1
5	2	1 .07 1 1 1	1 .06 1 1 1	15 1.25 4 4 1	9 .77 2 2 1	6 .54 4 3 1	1 .09 1 1 1	2 .14 1 1 1	2
6	1	1	2	2	1	15 1.56 4 3 1	3 .25 2 2 1	1	1 .09 1 1 1

xvi) KEY TO FIGURES IN GRID OF INPUT DATA

IN EACH SQUARE FIGURES REFER TO :

NUMBER OF DELIVERY CALLS
QUANTITY OF GOODS TO BE DELIVERED
DISTRIBUTION SPEED RATING
TRUNKING SPEED RATING
LAND RATING

(xvii)

INPUT DATA SUMMARY

TOTAL GOODS TO BE DELIVERED	25.0
TOTAL DELIVERIES TO BE MADE	295
NO. OF SQUARES CONTAINING WORK	33

XVIII)

(XIX) ROUTE STATISTICS

NO.	TIME	GOODS	MILES	CALLS	(I,J)					
1	7.9	1.1	99.0	13	(47,39)	(47,40)	(47,41)	(46,41)	(46,40)	
2	7.7	1.0	109.4	12	(46,37)	(47,37)	(48,38)	(48,38)	(47,38)	(46,3
3	7.8	1.2	72.0	13	(45,36)	(46,36)				
4	8.0	1.2	68.0	14	(45,40)	(46,40)				
5	7.7	1.2	63.5	14	(45,37)	(45,36)				
6	7.8	1.3	58.9	15	(45,39)	(45,40)				
7	8.0	1.3	77.1	16	(44,40)	(45,39)	(46,38)	(45,38)		
8	7.8	1.3	67.5	15	(43,40)	(42,40)	(41,40)	(42,39)		
9	8.0	1.3	67.1	16	(42,38)	(41,38)	(41,37)	(42,37)	(43,37)	
10	7.8	1.4	51.1	16	(44,38)	(44,37)	(43,37)			
11	7.8	1.4	39.9	17	(43,40)					
12	7.8	1.4	54.0	16	(44,39)	(44,40)	(43,40)			
13	7.9	1.6	32.1	18	(44,39)					
14	7.9	1.5	46.0	18	(44,38)	(44,39)	(43,39)			
15	7.9	1.6	26.4	20	(43,39)					
16	7.8	1.6	19.7	18	(43,38)					
17	8.0	1.6	20.2	19	(43,38)					
18	8.0	1.6	20.2	19	(43,38)					
19	2.9	.5	12.1	6	(43,38)					

(IX) TOTALS

GOODS	=	25.0
MILES	=	1000.2
DROPS	=	295
TIME	=	144.5
ROUTES	=	19

XX)

VEHICLE SCHEDULES - METHOD 1

VEHICLE CLASS	VEHICLE NO.	ROUTE NUMBERS	TOTAL TIME	UTIL. (%)
1	1	18 / 17 / 9 / 7 / 4 /	40.0	99.91
1	2	13 / 1 / 14 / 15 / 12 /	39.4	98.56
1	3	10 / 8 / 3 / 6 / 11 /	39.1	97.63
1	4	16 / 5 / 2 / 19 /	26.1	65.24

EXIT F.F.DATARUN

BRSL PATHFINDER DATAHANDLER

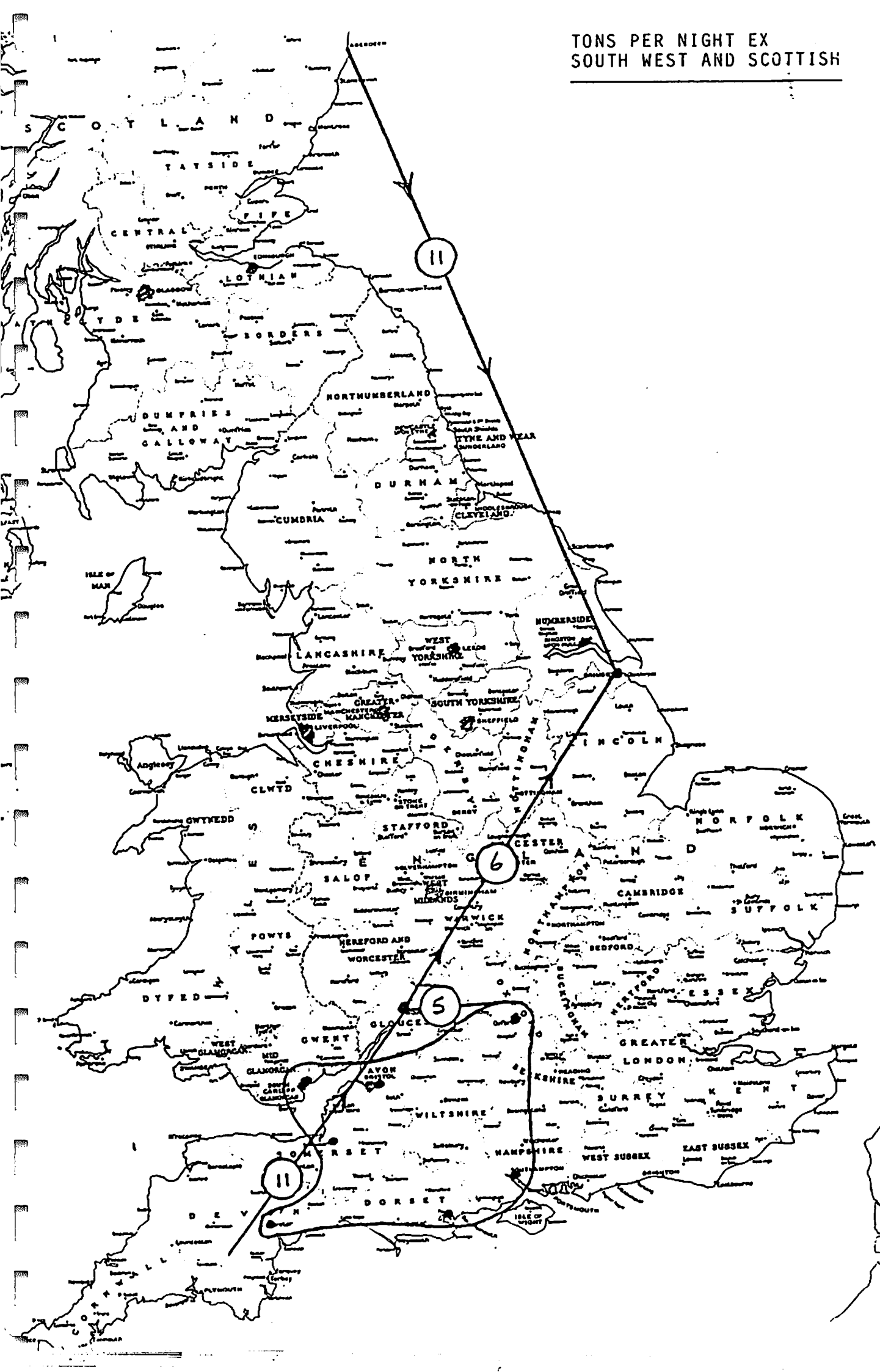
	1	2	3	4	5	6	7	8	9
1							5 .40 1.84	1 .05 .26	
2		5 .23 1.06	3 .27 1.22	24 2.04 9.29	13 1.12 4.94	19 1.63 7.51	9 .82 3.70	1 .07 .31	
3			3 .23 1.11	25 2.11 9.33	26 2.24 10.11	8 .66 3.01	5 .40 1.39	1 .06 .28	
4		1 .06 .27	2 .14 .68	62 5.26 23.16	15 1.32 5.68	7 .61 2.76	2 .15 .59	2 .19 .83	1 .07 .32
5		1 .07 .29	1 .06 .33	15 1.25 5.91	9 .77 3.47	6 .54 2.61	1 .09 .37	2 .14 .66	
6						18 1.56 7.20	3 .23 1.25		1 .09 .37

KEY TO FIGURES IN GRID OF PROBLEM DATA

IN EACH SQUARE FIGURES REFER TO :

SCALED NUMBER OF DELIVERY CALLS
SCALED QUANTITY OF GOODS TO BE DELIVERED
TIME (IN HOURS) TO COMPLETE WORK IN SQUARE

TONS PER NIGHT EX
SOUTH WEST AND SCOTTISH



APPENDIX 11

Calculations of the trunking resources for fish not distributed on the three distribution systems considered were made as follows.

Total trunking resources required to deliver from 3 port areas (i.e. Grimsby, South West and Scotland) to depots nationwide were:

650 tons trunked on 15 vehicles with 19 drivers travelling 24335 miles/week.

a) Therefore, trunk resources to fish markets and distribution centres are:

643 tons trunked on 15 vehicles with 19 drivers travelling 24074 miles/week.

b) or for options 4 and 7:

1332 tons trunked on 31 vehicles with 39 drivers travelling 49870 miles/week.

APPENDIX 12

OUTPUT STATISTICS FROM PATHFINDER RUNS

OPTION 1

		TONS	DROPS	MILES	VEHICLES
GFMS DEPOTS	Sheffield	21	276	986	4
	Leeds	64	852	7225	14
	Grimsby	13	179	1274	3
	Kendal	3	38	295	1
	Manchester	60	799	3597	11
	Stoke	9	115	402	2
	Wrexham	9	128	975	2
	Exeter	24	330	2930	6
	Bridgwater	5	71	369	1
	Bristol	24	310	1329	4
	Cardiff	37	489	2858	7
	Gloucester	8	108	604	2
	Oxford	7	96	735	2
	Birmingham	47	634	2521	8
	Nottingham	26	344	1626	5
	Dunstable	14	184	818	3
	Wisbech	8	108	742	2
	Bury St Edmunds	16	217	1530	4
	Norwich	7	88	480	2
	Brentford	34	459	1799	6
	Mid - Kent	39	518	2866	8
	Poole	13	177	670	2
	Southampton	51	674	3859	9
SW	Gloucester	56	511	15198	22
SCOTTISH	Newcastle	21	219	3141	5
	Haydock	17	182	1657	4
	Bilston	77	224	2344	4
FISH MARKETS	Sheffield	29	360	1049	5
	Leeds	53	649	2082	8
	Grimsby	15	180	1139	3
	Hull	15	180	856	3
	North Shields	56	681	3052	10
	Liverpool	50	610	2247	8
	Manchester	59	720	2159	9
	Preston	24	289	1186	4
	Birmingham	59	719	3410	9
	Coventry	20	250	1121	4
	Leicester	11	141	499	2
	Nottingham	20	250	815	3
	Billingsgate	546	3694	29967	83
DIST. CENTRES	Exeter	32	398	3764	7
	Bristol	26	313	1655	5
	Cardiff	37	455	2761	7
	Cambridge	53	653	4998	10
	Norwich	14	170	1208	3
	Southampton	70	852	5454	12

OPTION 2

		TONS	DROPS	MILES	VEHICLES
	Sheffield	21	276	986	4
	Leeds	64	852	7225	14
	Grimsby	13	179	1274	3
	Kendal	3	41	326	1
	Manchester	69	875	3923	12
	Stoke	10	124	427	2
	Wrexham	10	140	1060	3
	Exeter	28	354	3319	6
	Bridgwater	6	78	398	1
	Bristol	27	340	1418	5
	Cardiff	42	546	3201	8
	Gloucester	9	118	706	2
	Oxford	8	110	746	2
	Birmingham	53	683	2681	9
	Nottingham	29	374	1743	5
	Dunstable	16	202	862	3
	Wisbech	9	114	774	2
	Bury St Edmunds	18	236	1616	4
	Norwich	7	99	500	2
	Brentford	34	459	1799	6
	Mid - Kent	43	537	3141	8
	Poole	15	195	737	3
	Southampton	58	742	4312	10
SW	Gloucester	-	-	-	-
SCOTTISH	Newcastle	21	219	3141	5
	Haydock	17	182	1657	4
	Bilston	177	224	2344	4
FISH MARKETS	Sheffield	29	360	1049	5
	Leeds	53	649	2082	8
	Grimsby	15	180	1139	3
	Hull	15	180	856	3
	North Shields	56	681	3052	10
	Liverpool	50	610	2247	8
	Manchester	59	720	2159	9
	Preston	24	289	1186	4
	Birmingham	59	719	3410	9
	Coventry	20	250	1121	4
	Leicester	11	141	499	2
	Nottingham	20	250	815	3
	Billingsgate	546	3694	29967	83
	Exeter	32	398	3764	7
	Bristol	26	313	1655	5
	Cardiff	37	455	2761	7
	Cambridge	53	633	4998	10
	Norwich	14	170	1208	3
	Southampton	70	852	5454	12

OPTION 3

		TONS	DROPS	MILES	VEHICLES
	Sheffield	25	320	1100	4
	Leeds	78	1000	10011	19
	Grimsby	16	206	1518	3
	Kendal	4	46	295	1
	Manchester	81	1006	5098	14
	Stoke	12	146	499	2
	Wrexham	13	164	1349	3
	Exeter	28	354	3319	6
	Bridgwater	6	78	398	1
	Bristol	27	340	1418	5
	Cardiff	42	546	3201	8
	Gloucester	11	142	825	2
	Oxford	10	123	861	2
	Birmingham	62	798	3460	10
	Nottingham	35	446	2197	6
	Dunstable	16	202	862	3
	Wisbech	9	114	774	2
	Bury St Edmunds	18	236	1616	4
	Norwich	7	99	500	2
	Brentford	34	459	1799	6
	Mid - Kent	43	537	3141	8
	Poole	15	195	737	3
	Southampton	58	742	4312	10
SW	Gloucester	-	-	-	-
SCOTTISH	Newcastle	-	-	-	
	Haydock				
	Bilston	-	-	-	-
FISH MARKETS	Sheffield	29	360	1049	5
	Leeds	53	649	2082	8
	Grimsby	15	180	1139	3
	Hull	15	180	856	3
	North Shields	56	681	3052	10
	Liverpool	50	610	2247	8
	Manchester	59	720	2159	9
	Preston	24	289	1186	4
	Birmingham	59	719	3410	9
	Coventry	20	250	1121	4
	Leicester	11	141	499	2
	Nottingham	20	250	815	3
	Billingsgate	546	3694	29967	83
	Exeter	32	398	3764	7
	Bristol	26	313	1655	5
	Cardiff	37	455	2761	7
	Cambridge	53	633	4998	10
	Norwich	14	170	1208	3
	Southampton	70	852	5454	12

OPTION 4

		TONS	DROPS	MILES	VEHICLES
	Sheffield				
	Leeds				
	Grimsby				
	Kendal				
	Manchester				
	Stoke				
	Wrexham				
	Exeter				
	Bridgwater				
	Bristol				
	Cardiff				
	Gloucester				
	Oxford				
	Birmingham				
	Nottingham				
	Dunstable				
	Wisbech				
	Bury St Edmunds				
	Norwich				
	Brentford				
	Mid - Kent				
	Poole				
	Southampton				
SW	Gloucester				
SCOTTISH	Newcastle				
	Haydock				
	Bilston				
FISH MARKETS	Sheffield	66	786	2229	10
	Leeds	119	1382	4405	18
	Grimsby	25	314	1965	5
	Hull	27	340	1538	5
	North Shields	115	1350	6114	19
	Liverpool	110	1294	4789	17
	Manchester	136	1622	4820	20
	Preston	49	590	2342	8
	Birmingham	142	1544	6875	20
	Coventry	49	528	2197	7
	Leicester	29	312	935	4
	Nottingham	50	544	1588	7
	Billingsgate	508	3436	23441	73
	Exeter	53	710	5858	11
	Bristol	56	727	3022	9
	Cardiff	76	999	5124	13
	Cambridge	81	941	12007	18
	Norwich	29	328	1787	5
	Southampton	120	1692	9568	23

OPTION 5

		TONS	DROPS	MILES	VEHICLES
	Sheffield	21	276	986	4
	Leeds	64	853	7225	14
	Grimsby	13	179	1274	3
	Kendal	3	41	326	1
	Manchester	70	842	3894	12
	Stoke	10	122	452	2
	Wrexham	10	137	1028	2
	Exeter	28	342	3245	6
	Bridgwater	6	76	417	1
	Bristol	27	329	1411	5
	Cardiff	42	327	3096	8
	Gloucester	9	115	692	2
	Oxford	8	108	742	2
	Birmingham	54	657	2648	9
	Nottingham	30	362	1736	5
	Dunstable	16	197	855	3
	Wisbech	9	112	752	2
	Bury St Edmunds	18	229	1562	4
	Norwich	7	96	490	2
	Brentford	34	459	1799	6
	Mid - Kent	43	537	3141	8
	Poole	15	189	741	3
	Southampton	58	712	4186	10
SW	Gloucester				
SCOTTISH	Newcastle	21	219	3141	5
	Haydock	17	182	1657	4
	Bilston	17	224	2344	4
FISH MARKETS	Sheffield	29	360	1049	5
	Leeds	53	649	2082	8
	Grimsby	15	180	1139	3
	Hull	15	340	1538	5
	North Shields	56	681	3052	10
	Liverpool	50	610	2247	8
	Manchester	59	720	2159	9
	Preston	24	289	1186	4
	Birmingham	59	719	3410	9
	Coventry	20	250	1121	4
	Leicester	11	141	499	2
	Nottingham	20	250	815	3
	Billingsgate	546	3694	29967	83
	Exeter	32	398	3764	7
	Bristol	26	313	1655	5
	Cardiff	37	455	2716	7
	Cambridge	53	653	4998	10
	Norwich	14	170	1208	3
	Southampton	70	852	5454	12

OPTION 6

		TONS	DROPS	MILES	VEHICLES
	Sheffield	25	295	1000	4
	Leeds	78	923	8138	16
	Grimsby	16	190	1402	3
	Kendal	4	43	357	1
	Manchester	81	930	4349	13
	Stoke	12	135	513	2
	Wrexham	13	152	1214	3
	Exeter	28	342	3245	6
	Bridgwater	6	76	417	1
	Bristol	27	329	1411	5
	Cardiff	42	527	3096	8
	Gloucester	11	131	753	2
	Oxford	10	113	788	2
	Birmingham	62	739	2914	10
	Nottingham	35	412	1924	6
	Dunstable	16	197	855	3
	Wisbech	9	112	752	2
	Bury St Edmunds	18	229	1562	4
	Norwich	7	96	490	2
	Brentford	34	459	1799	6
	Mid - Kent	43	537	3141	8
	Poole	15	189	741	3
	Southampton	58	712	4186	10
SW	Gloucester				
SCOTTISH	Newcastle	-	-	-	-
	Haydock	-	-	-	-
	Bilston		-	-	-
FISH MARKETS	Sheffield	29	360	1049	5
	Leeds	53	649	2082	8
	Grimsby	15	180	1139	3
	Hull	15	340	1538	5
	North Shields	56	681	3052	10
	Liverpool	50	610	2247	8
	Manchester	59	720	2159	9
	Preston	24	289	1186	4
	Birmingham	59	719	3410	9
	Coventry	20	250	1121	4
	Leicester	11	141	499	2
	Nottingham	20	250	815	3
	Billingsgate	546	3694	29967	83
	Exeter	32	398	3764	7
	Bristol	26	313	1655	5
	Cardiff	37	455	2716	7
	Cambridge	53	653	4998	10
	Norwich	14	170	1208	3

OPTION 7

		TONS	DROPS	MILES	VEHICLES
	Sheffield				
	Leeds				
	Grimsby				
	Kendal				
	Manchester				
	Stoke				
	Wrexham				
	Exeter				
	Bridgwater				
	Bristol				
	Cardiff				
	Gloucester				
	Oxford				
	Birmingham				
	Nottingham				
	Dunstable				
	Wisbech				
	Bury St Edmunds				
	Norwich				
	Brentford				
	Mid - Kent				
	Poole				
	Southampton				
SW	Gloucester				
SCOTTISH	Newcastle				
	Haydock				
	Bilston				
FISH MARKETS	Sheffield	66	402	1687	8
	Leeds	119	726	3385	15
	Grimsby	25	152	1442	4
	Hull	27	165	1152	4
	North Shields	115	701	4832	16
	Liverpool	110	671	3518	14
	Manchester	136	829	3725	16
	Preston	49	299	1866	7
	Birmingham	142	866	5884	18
	Coventry	49	299	1860	6
	Leicester	29	177	808	4
	Nottingham	50	305	1355	6
	Billingsgate	508	3436	23441	73
	Exeter	53	323	4230	9
	Bristol	56	338	2311	8
	Cardiff	76	463	3943	11
	Cambridge	81	494	5680	12
	Norwich	29	177	1486	4
	Southampton	120	730	6906	17

A Study of Fresh Fish Distribution in the UK BRS Consultancy Report

Technical Report No. 254
December 1984
Revised October 1985

Sea Fish Industry Authority
Industrial Development Unit

A STUDY OF FRESH FISH DISTRIBUTION IN THE U.K.

BRS CONSULTANCY REPORT

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A STUDY OF FRESH FISH DISTRIBUTION IN THE U.K.
BRS CONSULTANCY REPORT

SUMMARY

The main body of the report is taken up with an explanation of the computer simulations carried out by BRS Consultancy Service (the BRS Report) into the costs of delivering fish supplies between ports and retailers. The work was commissioned by the SFIA and carried out by a study team of SFIA and BRS Consultancy Service staff. The simulations assumed different levels of integration of the existing parallel, competing systems, culminating in a single system which would handle all deliveries of fish from UK ports into English/Welsh retail outlets.

This was done as a means of costing the degree of waste which, by common consent, must occur within the existing system where deliveries are duplicated and part-filled vehicles follow the same routes. In the event, the degree of saving of cost is adjudged to be small in most of the scenaria tested. It is suggested that this is due to the vast difference in the levels of service (i.e. places served by the transport companies) offered from different ports at the present time, whereas the simulations assume a standard level of service for all routes after integration. The comparison between possible options of integration is thus made against a higher average standard of service than now exists and the nett saving in transport costs is made up of a saving due to the higher efficiency of an integrated system offset by the extra costs of providing a higher standard of service. Note, however, that savings of between 10 and 17% are predicted for a scenario in which secondary deliveries from depots or wholesale markets are integrated in a single system.

Perhaps the most useful feature of the report is the way in which it quantifies the potential savings to be made by replacement of the existing system of secondary distribution depots and wholesale market by wholesale market/depot locations alone and also names the logical sites for such facilities. Thus it paves the way towards a programme of investment in intermediate holding facilities for chilled fish during transit, giving the optimum locations and likely throughputs at each location. Note that the implied change in operating practices at the wholesale markets whereby direct consignments are accepted for onward transmission to the eventual consignee would require a radical departure from present practices. However, the programme runs have shown that only when this change is introduced does the possibility of an integrated transport system make any worthwhile contribution to the financial fortunes of the industry.

H. R. English,
Manager, Development Engineering.

Sea Fish Industry Authority
Industrial Development Unit

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A STUDY OF FRESH FISH DISTRIBUTION IN THE U.K.

BRS CONSULTANCY REPORT

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A STUDY OF FRESH FISH DISTRIBUTION IN THE U.K.
BRS CONSULTANCY REPORT

1. INTRODUCTION

The present road vehicle based fresh fish distribution system was developed to replace the rail delivery network which had previously served the same purpose but which was phased out in the 1950/60's. The rail delivery network had provided a service linking the supply ports with major wholesale markets (the railway company providing road transfer between railhead and market) or town railheads (with collection of packages by wholesaler/retailer); a similar level of service was offered to consignors from any of the main ports in the country. The replacement road services offer different levels of service from different ports and reflect the form of service which has been provided to serve the requirements of the merchants in the different ports. Thus a merchant in one port may have access to a service which provides deliveries to individual retailers in more than 1800 different towns and villages in Britain while at other ports the merchants may have access to one inland wholesale market only. The road transport operators providing the delivery services may be specialist divisions of general carrying companies or may limit their activities to fish and fish product carrying. In a few cases fish may be carried with other cargoes. Ownership of the road transport companies is vested in merchant or merchant association's interests in some cases. Most of the companies provide deliveries from a limited range of ports in a defined regional area. Some transfer of cargoes between companies takes place at the secondary distribution stage but this traffic represents less than 1% of all cargoes carried. Thus the present delivery systems may be considered as operating independantly of each other and criticism is made of the high cost and the degree of duplication in delivery routes.

The White Fish Authority, in the past, carried out a number of studies aimed at identifying areas for potential saving by consolidation of deliveries from the major ports to the wholesalers and retailers. The most intensive study, carried out in 1972 and using computer simulation (Ref. WFA Report 84), attempted to define the savings which could accrue by providing a joint delivery service from the ports of Fleetwood, Grimsby, Hull and Lowestoft. Development of the Authority's proposals was thwarted when the representatives of the different ports could not reach agreement on the level of delivery service to be provided. A service was eventually provided by an independant carrier which offered an integrated delivery service from the four ports listed above, but only as a competitor to other carriers serving the same ports. Further integration involving a merging of the interests of this carrier and the Grimsby Fish Merchants Association transport schemes took place in late 1983 but the new organisation still suffers from problems of competition for all its cargoes by general haulage companies. Some duplication of effort and provision of unnecessary capacity is thus inevitable.

It should be noted at the outset that the level of service demanded by merchants is very high as far as reliability in delivery times is concerned. The haulier contracts to deliver fish on the day after receipt of the consignment at his port depot (with some exceptions at weekends) and commits himself to whatever level of mileage from his fleet is needed to meet this target.

In 1982 and 1983 SFIA staff carried out a series of investigations into transport operations in the fish distribution system as part of a wider data collection exercise on the operations of the industry. It was decided that a repeat of the 1972 exercise, covering a greater number of ports, would be useful in identifying potential areas for cost saving in transportation. This was in response to comments from merchants on the high costs of the service provided for them and by comments from hauliers on the difficulty in providing the required level of service, particularly against competition for the more profitable sections of the business.

A contract was awarded to BRS Consultancy to collect and analyse data to define the cost advantages of integration of the different or competing elements of the current road transport system. Data collected by the SFIA would also be included in the analysis and it was from this original data that the definitions of degrees of integration to be assessed were made. The rationale behind the definitions is given in the report.

It should be noted that for the purposes of this report, the term merchant has been used to signify the person or organisation which purchases fish at the quayside and consigns it to wholesalers, based at the inland wholesale markets, or directly to retailers, etc., bypassing the intermediate wholesale stage. The term retailer as used in this report is intended to include restaurants, hotels and institutions which also take fish deliveries through the existing system.

2. METHODOLOGY OF THE STUDY

2.1 Establishment of Level of Service

The fresh fish road distribution chain has five main elements as listed below:-

Trunk Routes:

a). Trunker distribution from port to distribution depot.

b). Trunker distribution from port to inland wholesale market. (The carrier may also operate a collection service from port merchants to his trunker depot.)

Secondary Routes:

c). Secondary distribution from distribution depot to wholesale market.

d). Secondary distribution from distribution depot to retailer.

e). Secondary distribtion from inland wholesale market to retailer.

Elements a), b), c), and d) may be provided by a single carrier from a single port. Element e) may be provided by a professional carrier, by the wholesaler, or by the retailer collecting his own purchases from the wholesale market. In any event this element may duplicate a service available from at least some of the supply ports using Trunker and Secondary distribution via a distribution depot. Since the direct delivery to retailer service (elements a) and d)) is well established, it was considered that all potential amalgamations to be examined should offer this service in their new form. It was logical, therefore, to consider the potential amalgamations as increases to the Grimsby Fish Merchants' Association (GYFMA) system which already offers this service. Changes in the structure of this system during 1984/5 have not altered the findings of the study team.

2.2 Potential Stages of Integration

The potential amalgamations were considered in three stages with two options offered at each stage. At each stage an additional segment of the total traffic was added to the basic Grimsby FMA structure and the distribution depots list was modified as necessary to meet the needs of the new service. An impression of the changes involved at the different stages of integration is given in Fig. 1. In each case an estimate was made of the transportation costs (vehicle standing and running costs and labour charges) to provide the delivery services in the format defined in that stage. In each case the total cost is intended to represent the total transportation costs for all deliveres of UK landed fish into retail premises or institutional catering establishments in England and Wales. Scottish retail deliveries were excluded from the review since the study team had found that opportunities for potential amalgamation of systems were very limited given the concentration of consumption in the Forth/Clyde valleys, the variety of directions from which the necessary supplies arrived and the relative characteristics of most of the delivery routes. Though some potential for integration of Scottish transport systems is likely to exist, it cannot be quantified except in a study of much greater depth than could be achieved in this project.

2.3 Delivery Simulation

For English and Welsh deliveries, a BRS delivery simulation programme allocates appropriate supplies into areas some 10 km square, taking account of population and consumption in that area and also of the ratios of supplies obtained either directly from ports or via wholesale markets. The programme thus assumes that at least one retailer will be found in any square wherever road access is possible and wherever the population density justifies it. While this is patently false, it did not prove possible to accurately define the total numbers of delivery points (which, it must be remembered, includes

institutions, restaurants and fried fish shops as well as wet fish shops). The simplification of the programme is considered to have little effect on the overall cost estimates since the routeing programme would still accurately predict routes and total tonnages delivered on those routes even if the numbers and locations of stops could not be accurately stated. The BRS programme has already proved its value in prediction of costs for delivery of other commodities where delivery location information has been similarly restricted. In this instance it was decided to run the programme for two delivery options at each stage of integration, representing the maximum and minimum expected numbers of delivery calls respectively, using existing delivery information to define the required numbers.

2.4 Use of Pathfinder Program

The first requirement in the study was to define and analyse the present day situation - the "NOW" situation - by using available data on supplies, consumption, numbers of consignments handled by different carriers, trade through wholesalers, population densities and traffic conditions. Density and traffic condition information is already contained within the Pathfinder program though traffic speed factors (which range from 45 mph average speeds for trunker vehicles running on motorways to 12 mph for distribution vehicles operating in congested urban areas) refer to daytime rather than night time delivery schedules. This is not inappropriate, given the situation in the ultimate level of integration, as discussed later.

The results of the program run for the Secondary delivery sector in the "NOW" situation are given in Section 6.2 of the BRS report in the form of Tonnages carried per week, number of deliveries made, vehicle miles travelled and numbers of vehicles in service. Trunking requirements to serve the same system are defined in Section 7.2. Total vehicle and driver requirements for the whole system are listed in Section 8.2 (as Option 1) and annual operational costs for the complete

system are defined in Section 8.3 (Option 1). Note that costs of deliveries from wholesalers to retailers are based on the costs of a service supplied by a single company operating from the inland market. This is the only basis for which the available data could be used. At this stage the model allows for potential deliveries to retailers by as many as five different carriers.

At the different levels of integration, the changes introduced into the system involve taking out redundant capacity at the distribution depots by consolidation of two, then three, operations to run from a single chain of secondary depots and from the existing wholesale markets. In the final level of integration, the role of the distribution depots is transferred to the wholesale markets wherever practicable; it is necessary to retain a small number of distribution depots to serve areas which could not be effectively serviced from depots at the existing wholesale market locations. The list of depots utilised in the different levels of integration are shown in tables in Appendix 12 of the BRS report. The implication of this last level of integration is that fish purchases by a retailer either from a merchant at a distant port or from a wholesaler at a local market would be delivered in the same vehicle in a single delivery run. In all the other simulations these deliveries would be made by separate vehicles.

At each level of integration the problem of defining the number of retailers/restaurants/institutions to be served by the newly-structured system remains unresolved. Though data on total numbers of customers served by wholesalers, or by merchant associations, or by road transport carriers was available, it was not possible to determine the degree of duplication in the totals. It was, therefore, decided that at each simulation of the three levels of integration, two options would be calculated; one on the assumption that no deliveries were duplicated and that the total number of deliveries in the new system would equal the sum of the numbers of deliveries made by the separate components of the former system; the other that all deliveries were duplicated in

areas of common interest to two companies and that the new delivery schedule would be equal to the larger of the number of drops of the former separate systems. The results thus define the maximum and minimum possible combinations which might result from integration of two or more carriers into a new single unit.

In the BRS report the different options are identified as follows:-

Delivery Schedule Assumption	Not Common Drops	Common Drops
"NOW"	Option 1	Not applicable
Integration Stage I	Option 2	Option 5
Stage II	Option 3	Option 6
Stage III	Option 4	Option 7

It should be noted that the same list of distribution centres is used for both of the options investigated in a single stage. Identification of the distribution centre locations, of the tonnages handled, deliveries made and mileages run, is shown in a series of tables in Appendix XII of the BRS report.

It should be noted that the level of service provided rises with each stage of integration in that all supplies into the area of major consumption (that area of England lying to the South of the M61 and M62 motorways) are provided with a delivery service which allows all the consumption centres to be served from any of the supply ports. This is justified on the basis that a future system could not set limits on areas served when none exist now. However, since traffic from south to north of the M61/M62 is limited at present by competitive price consideration, it was decided that the policy of providing an any input/ any outlet service should be limited to areas south of this axis.

2.5 Results

Detailed results of the study are given in Sections 6, 7 and 8

of the report. Total operation costs of each option are shown in simplified form below:

Values in £000's

	Not Common Drops	Common Drops
"NOW"	7967	-
Integration Stage I	7771	7755
Stage II	7681	7599
Stage III	7211	6574

Value "NOW" = 100

	Not Common Drops	Common Drops
"NOW"	100	-
Integration Stage I	97.5	97.3
Stage II	96.4	95.4
Stage III	90.5	82.5

Vehicle requirements for the different levels of service are shown below:-

	Not Common Drops	Common Drops
"NOW"	40/455	-
Integration Stage I	42/440	42/439
Stage II	41/436	41/432
Stage III	41/409	41/369

Vehicle numbers shown are 32 GVW trunkers/7.4 GVW distribution vehicles respectively.

3. DISCUSSION OF RESULTS

3.1 Order of Confidence in Results

The Pathfinder program was developed to serve the needs of major manufacturers or distributors in control of their operations and has shown itself to be of immense value in accurate prediction of costs and resource requirements to serve defined purposes. Accuracies of 98% would be expected for prediction of costs when the following elements could be precisely identified.

a) Location of Loading Points.
b) Location of Delivery Points.
c) Throughput between each loading and delivery point.
d) Seasonal, weekly, daily variations in loads.
e) Level of service required/degree of acceptable delay.

In evaluating the work done on the SFIA study it must be acknowledged that the data provided or collected for elements (b) and (c) is subject to error. By the nature of the Industry, supply shortfalls can only be met by immediate transfers to other suppliers and it is impossible to quantify this element of "emergency" traffic in a short term data collection exercise such as was done for this study. In the circumstances, the error band must be considered to be of the order of say 4-5% about the predicted cost figures. The consultants would establish a high degree of confidence in the results of this level of accuracy by reference to other studies already carried out.

3.2 Operational Savings

The first reaction of a review of the results is that savings claimed for integration to Stages I and II are smaller than would have been envisaged by an observer of the present service activities. The reason for the saving may be found by examination of the practicalities of integration of the different operations and also by reference to the standards of service assumed by the programme.

On the practical side it will be noted that the transport carriers under review service the area of high population density (and hence consumption) by approach from entirely different directions. Thus integration of such exchange traffic as would be practicable would involve some or all of the companies in additional mileage to run to suitable transfer locations. The requirement for trunker vehicles is seen to increase from the present value, reflecting the additional mileage covered by trunker vechicles in all the revised systems. It is likely, of course, that some saving on trunker usage would be possible in practice by elimination of services for which no demand existed but the computer program specifically allows for all possible trunker service demands to be met and allocates vehicles accordingly. On the secondary distribution side the limited savings defined in vehicle numbers and costs for Stages I and II merely reflect the limited secondary delivery element of the services presently provided by the Scottish and South Western carriers in comparison with the secondary services provided by the GYFMA and from wholesale markets and minor ports by a variety of carriers. The savings in numbers of such vehicles (ranging from 15 to 23 for the different options in the first two stages of integration) are in fact greater than the numbers of secondary vehicles used by the Scottish and South Western carriers and this shows that the alternative carriers already have spare capacity on their secondary delivery services.

The extent of this spare capacity is highlighted when the results of the Stage III integration are studied. Spare capacity is used as available to reduce the demand for secondary vehicles by between 6 and 15%, dependant on the degree of duplication of deliveries provided by the carriers prior to integration. Examination of the more detailed results given in Section 6 of the BRS report shows the savings in specific areas to be even more significant (ranging from 8% to about 20%), while some other areas would see little change. This is a reflection of the fairly large group of vehicles (about 120) which are allocated on delivery duties from minor ports to nearby inland areas and for which no change in mode of operation could be identified.

An eventual system of integration at Stage III level would be unlikely to take the form defined in the model simulation since some proportion of the traffic from wholesale markets would inevitably be handled by retailers or other customers taking their purchases away in their own transport. Nevertheless, the potential savings of this level of integration are seen as providing the only case for an integration exercise at all. At the more restricted levels of integration, the projected annual savings of between £190,000 and £370,000 on transportation costs are not seen as sufficient to support the new management arrangements which would be required by the revised distribution system. It should be noted that the Pathfinder simulation assumes that delivery services are controlled to provide a service no greater than that required on a particular night's deliveries, rather than to provide a continuously repeatable timetable. Thus information on loadings and destinations and on vehicle progress must be continuously monitored. The costs of this monitoring and control service would be an addition to the current management costs incurred by the carriers.

3.3 Implementation of Integration Proposals

Although the programme runs were carried out in such a way as to simulate progressive levels of integration, it can be seen that the third stage can be implemented on its own with or without any formal integration of individual carriers' trunking operations. What is required is agreement between carriers and wholesale merchants at each market to provide:

i) A delivery service to retailers provided by a single carrier and based at or near the inland wholesale market.

ii) Adequate storage faciltiies at the market for supplies arriving overnight from ports and intended for direct delivery to retailer rather than sale at the market.

iii) Loading facilities for secondary distribution vehicles accepting fish from the wholesale market as well as from the holding store, (ii) above.

iv) Independant staff to control the operation.

It is essential that the organisation retains its independence in order to preserve the confidentiality of trading links which both port and wholesale merchants would wish to see retained.

The immediate source of labour and vehicles for the new secondary delivery service would be those resources of the existing carriers. Though the programme runs identify an overall saving in transport requirements, it must be remembered that:

a) Direct deliveries currently handled by the carriers represent only a small proportion of total deliveries of fresh fish, and

b) The wholesale markets do not provide a co-ordinated delivery system of their own and much of the trade is handled in small lots by merchants or customers.

Thus the initial programme after establishment of wholesale market based carrier companies would be one of expansion (as those companies took over traffic previously leaving the market by a variety of means) towards the fleet sizes defined in the table. It is suggested that the overall reduction in fleet size identified in the study would be seen in the areas of merchants' and retailers' fleets.

3.4 Quality of Delivered Consignments in the Integrated System

Though evaluation of quality aspects of the distribution system did not form part of the BRS Terms of Reference, it is necessary to keep these aspects in mind when reviewing the results of the BRS study. In

the recent SFIA staff review of the distribution system, the factors which were seen as likely to reduce the quality of fish offered for sale and which could be attributed to actions involving the road carriers were:

i) Lack of control over both temperature and hygiene caused by deliveries into unsuitable locations (e.g. consignments left on pavements outside premises during early hours of the morning), and

ii) Use of open vehicles for secondary distribution.

It should be noted that the appropriate solution for the problems of (i) above was seen as involving greater use of well-insulated tamper-proof packages and that this would also reduce the detrimental effects of use of open vehicles. In the absence of any uniform defined standard for transport of chilled fish consignments, the individual merchant would be advised to take whatever individual protective methods that he could justify, given sales price restraints on his products.

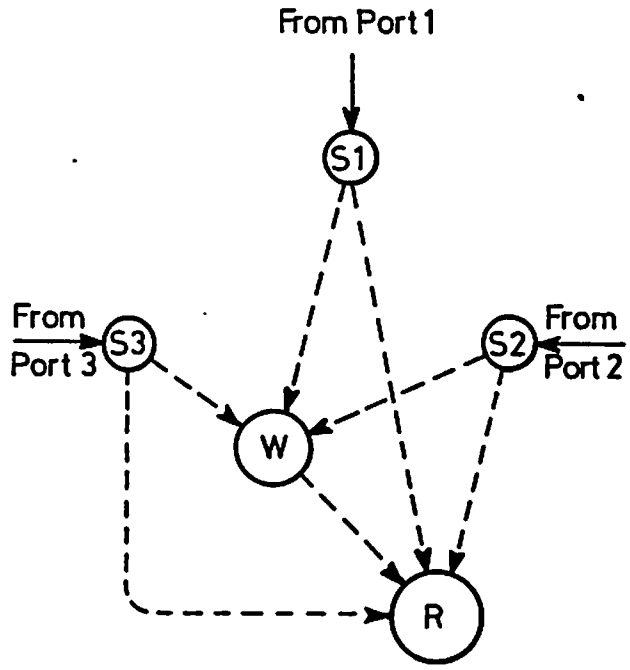
The results of the BRS study suggest that a different approach based on better environmental control for consignments (by provision of suitable temporary storage facilities and specialist vehicles) might be justified and it should be noted that the features which would be a necessary part of such a system are identified by the study. These are:

i) Provision of chilled facilities at a limited number of strategic locations.

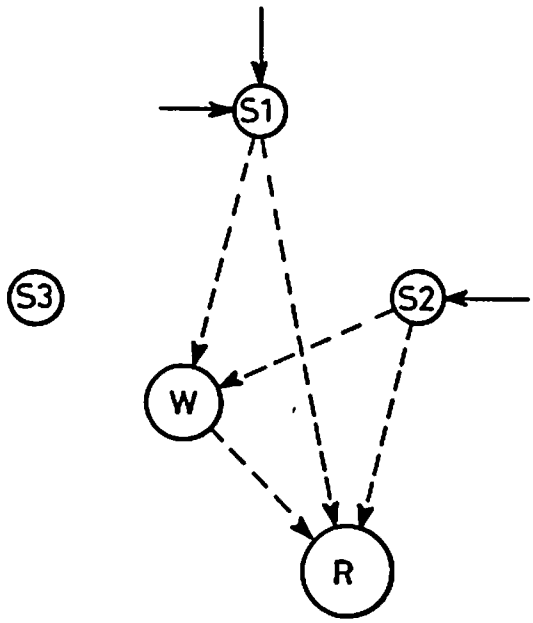
ii) Revision of the secondary delivery system to use the minimum possible numbers of such vehicles.

In both cases the additional costs can be defined since the programme identifies the necessary minimum structure to provide an adequate service.

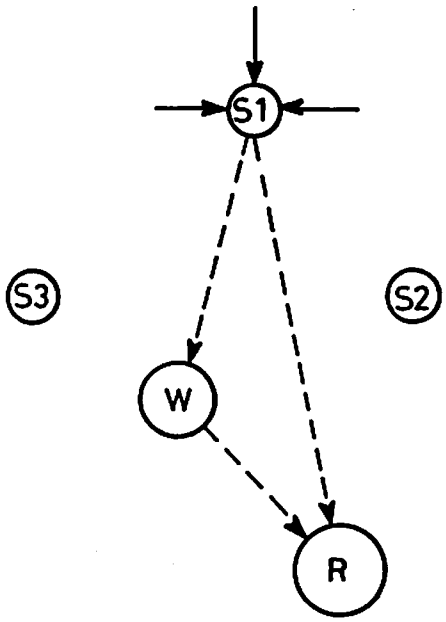
A first evaluation of the size of facilities can be made by reference to the tables in Appendix 12 of the report though some reference to local conditions and opportunities would always be necessary. As an example, it will be seen that the Sheffield area is seen as requiring 50 tonnes per week (21+29) of chilled fish/products at the present time (see Option 1 Table in Appendix 12) but that this figure rises to 66 tonnes per week when Stage III integration is considered and that this tonnage is now handled at the wholesale market depot. The increase in tonnage is a result of the revision of boundaries as a result of the reduction in numbers of distribution centres. A typical single night figure within the weekly total would be about 17 tonnes, equally divided between fish received for direct onward distribution or fish intended for sale by the wholesalers. The selected size for the chill store would lie within the range 8.5 tonnes to 17 tonnes, the eventual size to be dependant on the extent of chilled storage already available at wholesalers premises.



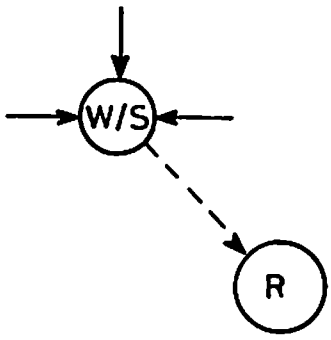
'Now'



Integration Stage I



Integration Stage II



Integration Stage III

Key:

- (S) Secondary Distribution Depot
- (W) Wholesale Market
- (R) Retailers
- ——— Trunker Deliveries
- ------ Secondary Deliveries

Distribution of Fresh Fish. Services Provided at Different Levels of Integration

Fig.1