

# FURNITURA MANUFACTURING

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## **ABSTRACT**

Furnitura Manufacturing is a manufacturer of bookcases for office use and is currently considering some major alterations to its logistics. It is your task to help them plan an investigation into which of a number of proposed alternatives will be the most lucrative choice.

The starting point for the investigation is a letter from the CEO containing an assignment, which it is your task to carry out. The result should be a report containing a plan for how to carry out the investigation, including a discussion on:

- Which costs will be relevant to study closer and why.
- From which parts of the flows these costs originate.
- How these costs relate to customer service.
- How overall profitability will be affected.
- What type of data is necessary to carry out a detailed investigation.

*Key Words: Logistics costs, Customer service, Direct delivery, Office furniture, Sweden.*

## **1. Introduction to the case**

Furnitura Manufacturing is a manufacturer of bookcases for office use and is currently considering some major alterations to its logistics. It is your task to help them plan an investigation into which of a number of proposed alternatives will be the most lucrative choice.

## **2. Letter from the CEO**

### **2.1. Background**

Over the past few years, our customers have increasingly demanded better service, and we receive an increasing number of complaints about our inability to deliver directly to customer sites. We have therefore decided to conduct an overview of our market offer in order to find opportunities for enhancing our overall customer service.

Our goal is to deliver directly to the customer the working day following the order receipt. This however needs to be made without any substantial cost increases, since margins in our industry segment are growing thinner each year.

The investigation that I would like you to conduct should give sufficient support to decide which solution will be the most lucrative alternative for Furnitura Mfg. The main alternatives are one-day direct distribution either from our current warehouse on the factory site in Grums, or from the prospected Furnitura Group DC in Norrköping, Sweden. We believe that moving our finished goods inventory to the Norrköping DC will be beneficial, since this is geographically closer to our main customer base. These two alternatives should be compared to our current weekly distribution via Furnitura Group retail stores. Further, the alternatives should also be compared with regard to different levels of total delivery service.

According to an estimate made by a marketing consultant we have hired previously, we believe that through this new market offer we can increase our market share by as much as ten per cent, since none of our competitors have yet attempted anything similar. Such a sales increase will however require a more or less impeccable delivery service; if the total service level is lower we might not realize the full ten per cent. We are prepared to accept a smaller sales increase if the resulting costs for achieving a larger increase will become too great. What I would like is to find the mix of service and delivery alternative which will be most profitable for us.

### **2.2. Assignment - initial report**

At this stage, before going into a detailed investigation or any calculations, I would like you to prepare an initial report in which you describe how you intend to conduct the investigation. In the report, I would like to see which costs will be affected by switching from our current distribution system to any of the proposed alternatives. We also require an explanation of why these costs will be affected, in which parts of our flows these costs originate, and finally how these costs relate to customer service.

Since better service might not only increase sales, but also costs, the decision as to which alternative and service level will be the best choice might not be clear-cut. Therefore, you are required not only to relate the options to cost, but also to overall profitability.

I realize that our staff will have to assist you with some data and that you might need in order to make further investigations. The report should therefore indicate what type of data you will require for your final investigation.

### **2.2.1. Conditions**

There are certain conditions that you should take into account for this investigation:

- If we decide to use the above described alternative with a DC in Norrköping, our current order picking staff will become redundant. The remaining dispatch buffer that will still be necessary can be handled by the forklift truck operators.
- From a previous investigation, we know that the Norrköping DC will be capable of on-time dispatch of 97.5 per cent of all orders as a yearly average.
- The prospected Norrköping DC is a Furnitura Group joint-venture. We will share the warehouse with some four or five other group members. Our rent for the warehouse is approximated to €179,000 / year.
- Our current production capacity is sufficient to accommodate a ten per cent sales increase without any investments or the need to hire additional staff.

### **2.2.2. Additional information**

Attached to this letter is an excerpt from a report prepared by a group of students who carried out a charting study on our behalf last year (see section 3). I hope you will find this information sufficient for preparing your report.

Yours sincerely,

*M. Lindenwald*

*CEO, Furnitura Manufacturing<sup>1</sup>*

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<sup>1</sup> Furnitura Manufacturing and all other names in this case are entirely fictitious.

### **3. Excerpt from student report**

#### **3.1. Background**

Furnitura Manufacturing (FM) was founded in 1930 under the name “Grums Möbelfabrik AB”, in Grums, Sweden. It was a family-owned carpentry firm that produced a variety of office furniture in solid wood. The company was quite profitable until the mid seventies, when competition from larger producers with more modern manufacturing processes changed the situation. With smaller margins in the entire business segment, many smaller producers closed down or were acquired by larger players. During this consolidation, a group of producers formed a joint venture that was named the Furnitura Group.

The idea which is central to the group is to cooperate on brand and product portfolios, as well as marketing and sales, but to continue producing locally. The assortment each actor produces has gradually narrowed down to different types of office furniture, and in the case of FM this consists of a series of shelf modules that can be combined in various ways into bookcases.

Today FM is an independent company but is still part of the group. The group owns a sales company that runs a total of 26 retail stores in large- and medium-sized towns and cities in Sweden. The group has also recently formed a central logistics company, Furnitura Logistics.

#### **3.2. Assortment**

The FM assortment consists of a bookcase system for office use. The bookcases are built up by a number of modules of different dimensions. All modules are compatible with each other, which gives the customer a wide range of possibilities. Each module consists of five veneered particle boards, which are assembled by the customer. The modules are available in three heights (40, 80 and 120 cm), two widths (40 and 80 cm) and two depths (20 and 40 cm); in all 12 module formats. Five veneer types are offered for all formats: Beech, Birch, Oak, Teak and Walnut.

The modules are assembled with patented fixtures that are included in the package. These fixtures are also used to combine modules to form bookcases.

Apart from modules, there are also separate shelf boards available for all module sizes (two widths, two depths) and materials.

The shelves can either be wall-mounted or stand freely on the floor. For these purposes, the assortment contains wall brackets and legs; the latter available in all five wood materials as well as aluminium. Brackets and legs are sold in pairs, and they are delivered with the necessary screws and washers.

#### **3.3. Customers and sales**

As mentioned in the introduction, all Furnitura products are sold in the group’s retail stores throughout the country. The products are intended for office use and only rarely therefore are the customers individuals. The stores never sell any products over the counter, instead, they function as showrooms where customers can place orders for the furniture that they want. Each store places orders at the respective manufacturers and then receives deliveries from group members once a week according to a fixed schedule. The schedule is adapted so that orders to stores in a certain region are shipped on the same weekday, and that the average volume dispatched from FM per day is kept somewhat even over each day of the week.

When the furniture arrives at the store, customers receive notice and are required to pick up the goods themselves. Store orders to manufacturers are placed continuously during the week. During four summer weeks, usually the first four of July, FM closes for summer holidays and does not ship anything to stores during this period.

### **3.3.1. Sales**

Sales are randomly spread over the year and no seasonal variation can be noticed in sales data. During 2004, a total of 132,543 products were sold, at a retail value of €4,504,190. For obvious reasons, retail stores in the larger cities account for most of the sales. Order volumes vary randomly from 400 to 4200 products per week, and range from orders consisting of single modules to orders for several large bookcases. Order volumes also vary from day to day; according to FM administrative staff between 10 and 50% of a week's sales can occur in one single day.

### **3.4. Materials supply**

FM buys raw materials and components from a limited number of suppliers. Apart from raw materials for boards, some articles and products, such as wall brackets, are bought from sub-contractors. This also applies to packaging. For all board materials, a safety stock of two weeks' consumption is maintained as a rule of thumb. For purchased components and packaging, a safety stock of one order quantity is maintained. All raw materials needed for in-house production are placed in the raw materials warehouse, whereas finished goods are placed in the finished goods warehouse. Two warehouse workers work in the raw materials warehouse with receiving and dispatching to production.

#### **3.4.1. Purchasing**

The particle board that constitutes the inner structure of the boards is bought from a local mill, whereas all veneer and trims are imported via an agent. All chemical products, i.e. veneer glue and lacquer, are bought from a wholesaler in Örebro. This supplier also sells the packaging materials. Apart from goods, some services such as all transportation, cleaning and catering are purchased from both national and local providers.

### **3.5. Production**

This section describes the manufacturing of boards at the FM plant in Grums, since other articles are bought from external vendors.

The production planning for the internally produced articles is rather simple. Re-order points trigger new batches, and all batch sizes are fixed. FM staff consider that this system functions well and that it renders a fairly even workload. According to production team leaders there are no real capacity constraints, and disturbances in the manufacturing process are quite uncommon.

Production buffers are routinely kept at two weeks' consumption for each article, in each buffer respectively. For planning purposes, team leaders use a one-week lead time for each manufacturing step respectively.

### 3.5.1. Veneering

The first step is veneering. This is the station where veneer sheets are glued onto the particle boards in order to form the raw materials that later on will be sawed into boards of different sizes. At this stage, the boards are called “full boards” since they are handled in their original 2,500x1,220mm format, i.e. standard dimensions for particle boards. Both sides are veneered regardless of what type of board the full board eventually will be sawed into, i.e. back, side, or shelf.

The operator spreads glue evenly across an entire particle board using a soft roller, and then places a veneer sheet on the glued side. This is then placed in a large press and remains there for a couple of minutes. The package is then removed, and the process is repeated for the other side. There are several presses that work in parallel at the veneering station, and the entire operation takes about ten minutes. The batch size is 20 full boards per veneer type. Three operators work in this department.



*A veneer press.*

After veneering, the boards are put onto special carts for further transportation to a drying room, where they are left for 48 hours in order for the glue to harden. This also serves as a raw materials buffer for the following station.

### 3.5.2. Sawing and edge trimming

Sawing full boards into the various dimensions required is an entirely manual operation. Operators lift boards from the carts mentioned above, and place them on the bed of the saw, which is preset for a certain dimension.

Once a full board is taken from the buffer, it is used in its entirety. Since all boards have dimensions that are fractions of the standard dimensions of particle boards, sawing renders very little waste.

The saw operators are also responsible for edge trimming. Edge trims are bands of veneer that come on large reels, and that are glued onto the edges of the boards with a rapid-hardening glue. When the trims have been glued, the operator finishes the board by shaving the edges, and then places the board on a pallet, which is moved to the next buffer by forklift trucks.

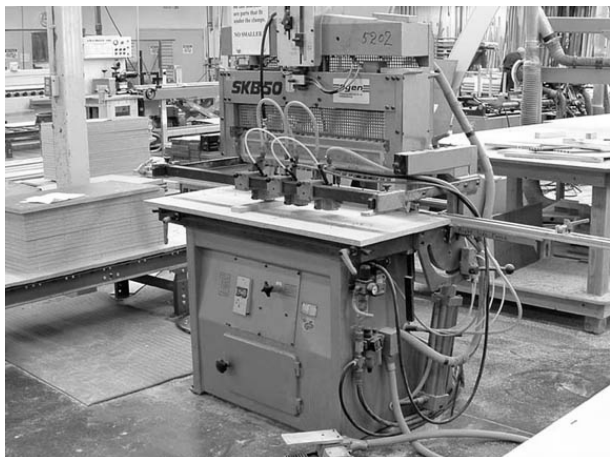


*A saw.*

The operation time for sawing and edge trimming is about five minutes, and the batch size is 50 for each article respectively. Three operators work in this department.

### **3.5.3. Drilling and milling**

Side- and back boards are drilled with holes for the fixtures, whereas shelf boards get a slit milled in each side. The drilling and milling station is equipped with an array of machines that are preset for different hole patterns, depending on the dimension and intended usage of the board. The same applies for the milling operation, which means that operations are very quick at this station, only about two minutes.



*A drilling machine.*

All handling at this station is manual, and when boards are drilled they are replaced onto the pallet for transportation to the next buffer. Batch sizes for drilling are 50 boards of one type (combination of dimension and material), whereas milling is done 100 boards at a time. Three operators work in this department.

#### **3.5.4. Lacquering**

All boards are lacquered before they are ready for delivery. Lacquering is also a manual operation and is done in closed boxes in the paintshop. Before lacquering, the boards are placed in special carts. When the operation is finished, the cart is rolled to the drying buffer where boards are left for 24 hours in order to give the lacquer time to harden. Then the boards are placed on pallets and transported to the finished goods warehouse.

Batch sizes are 50 boards at a time of each type respectively, and the operation time is about two minutes. Two operators work here.

### **3.6. Distribution**

This section describes the warehousing and distribution of the finished goods.

#### **3.6.1. Warehousing**

As mentioned above, finished goods are placed directly in the finished goods warehouse after receipt. Finished boards are placed on standard EUR-pallets in quantities of full batches, but before they can be piled onto each other they are wrapped in protective plastic, one at a time.

The finished goods warehouse is divided in two sections, a buffer zone and a picking zone. As the name implies, the buffer zone serves as a buffer between manufacturing and picking. This is the main storage of finished goods.

In the picking zone, one pallet of each article is stored in low storage bins for easy access. When a bin is emptied, the empty pallet is replaced by a full one by one of the forklift trucks.

A safety stock of four weeks' consumption, rounded up to the nearest multiple of a batch quantity, is kept in the buffer. As a rule of thumb, FM applies an inventory carrying cost of 20 per cent. Four pickers, two forklift operators and one foreman work here.

#### **3.6.2. Order handling**

Customers place their orders at the local Furnitura store. In the case of orders for FM products, the order is faxed and at receipt it is entered manually into the factory's planning system.

#### **3.6.3. Picking**

Each customer order generates a number of picking orders, one for each module or extra shelf board. This is due to the fact that modules are packaged one at a time and the picking is done manually straight into the package.

Picking orders are continuously sent to a printer that is placed in the picking zone of the warehouse. The printed orders are sorted according to dispatch day. This sorting is necessary to balance the uneven order flow against a fixed picking capacity. According to the picking staff, they normally handle between 400 and 500 picking orders a day.



The picker starts by taking a picking order from one of the sorted stacks. The packaging required is printed at the top of the order; one depending on the dimensions of the module of shelf board being picked, and another one to place the wall brackets or legs in. These are the first items that the picker places on the picking cart. Next, the picker walks through the picking zone along an S-shaped route, and stops at the required bins to pick one or two boards at each, depending on type (back board, side board, etc). At the end of the route are the bins for legs and wall brackets, which are placed in the smaller package. When the picking route is completed, the picker goes to the packaging station and wraps up the packages with adhesive tape and then leaves them at the dispatch station. The picking time for one picking order is on average three minutes.

#### **3.6.4. Dispatch and shipping**

Dispatch and shipping is handled by the two forklift operators. When the picker drops off a packaged and sealed order, it is marked with an address card and the necessary dispatch documentation. It is then placed in the dispatch zone until it is picked up by the lorry that arrives every day at about 5 pm.

#### **3.6.5. Transportation**

Transportation services are bought from a national freight forwarder. After pickup at the factory, the goods are transported to a terminal in Karlstad, and then forwarded through their network to a terminal close to the retail store, before finally being delivered. Goods are delivered the working day following pickup in Grums.

The transportation services are priced on a per-shipment basis. Freight charges are calculated based on shipment weight and distance, with weight-based quantity discounts.

# Furniture Manufacturing supplement - Freight pricing

## Freight calculation

**Consignment** means goods included in a waybill/transport document from one or several consignors to a consignee at a specified location, which are made available for carriage on one occasion. The weight/volume of the consignment may not be higher than the load capacity of the vehicle.

In the case of **goods that are difficult to stow**, because of the nature of the object or the packing means that they cannot be packed as normal groupage with other goods or maximum use cannot be made of the load area, the freight is calculated in such a way that consideration is given to the load area required by the goods. The term **flat metre** refers to a metre on the platform with the full width and height of the load space.

The terms **actual weight** or **gross weight** refer to the weight of the consignment as registered on the scales, including packing and loading accessories (e.g. pallets).

The term **bulk weight** refers to the consignment volume (length x width x height) expressed in cubic metres to two decimal points, including packing and loading accessories (e.g. pallets) multiplied by weight in accordance with the table (Calculating bulky goods) or when calculating flat metre, the number of flat metres to one decimal point multiplied by weight in accordance with the table (Calculating flat metre for bulky goods).

The term **chargeable weight** refers to the higher of the actual weight or the bulk weight.

## Bulky goods / goods that are difficult to stow

- Calculating bulky goods: chargeable weight per cubic metre 280 kg/m<sup>3</sup>.
- Calculating goods that are difficult to stow: chargeable weight 1950kg/flat metre.

## Calculation method

1. Determine actual consignment weight.
2. Determine distance between consignor location and consignee location.
3. Determine chargeable weight and the corresponding freight price according to pricelist (chargeable weight multiplied by freight price for applicable weight/distance interval).
4. Round calculated freight price to nearest integer.
5. Determine and add any additional charges for optional services and administration fee.

## Additional charges

For each consignment, an administration fee of €2 is charged.

## Freight pricelist

		Weight [kg]							
€ / 100 kg		-249	499	799	1499	2499	4999	9999	10000+
Distance [km]	20	12,34	6,49	3,80	3,07	2,46	2,03	1,72	1,63
	40	12,76	6,84	4,07	3,30	2,65	2,21	1,88	1,77
	60	13,18	7,20	4,34	3,52	2,84	2,38	2,04	1,92
	80	13,59	7,55	4,61	3,74	3,04	2,55	2,18	2,06
	100	14,01	7,90	4,87	3,96	3,22	2,72	2,34	2,20
	120	14,43	8,25	5,13	4,18	3,41	2,89	2,49	2,34
	140	14,86	8,60	5,40	4,40	3,60	3,06	2,65	2,48
	160	15,27	8,95	5,67	4,61	3,79	3,22	2,79	2,63
	180	15,69	9,30	5,94	4,84	3,98	3,39	2,95	2,77
	200	16,11	9,66	6,21	5,05	4,17	3,56	3,10	2,91
	220	16,52	10,01	6,48	5,27	4,35	3,73	3,26	3,05
	240	16,93	10,36	6,75	5,50	4,55	3,90	3,40	3,19
	260	17,37	10,71	7,01	5,71	4,74	4,07	3,56	3,33
	280	17,77	11,05	7,28	5,93	4,92	4,24	3,71	3,48
	300	18,19	11,40	7,54	6,16	5,12	4,40	3,87	3,62
	320	18,61	11,75	7,80	6,37	5,31	4,57	4,03	3,76
	340	19,02	12,09	8,07	6,59	5,49	4,74	4,17	3,90
	360	19,43	12,45	8,34	6,80	5,68	4,91	4,33	4,04
	380	19,87	12,80	8,61	7,03	5,88	5,08	4,48	4,18
	400	20,28	13,15	8,87	7,24	6,06	5,25	4,63	4,32
420	20,69	13,49	9,14	7,46	6,25	5,42	4,78	4,46	
440	21,11	13,84	9,41	7,69	6,44	5,58	4,93	4,60	
460	21,52	14,19	9,68	7,90	6,62	5,74	5,09	4,75	
480	21,93	14,53	9,93	8,11	6,81	5,91	5,24	4,89	
500	22,36	14,88	10,20	8,34	7,01	6,08	5,38	5,03	
520	22,77	15,24	10,47	8,55	7,19	6,25	5,54	5,17	
540	23,19	15,58	10,73	8,77	7,38	6,42	5,69	5,31	
560	23,59	15,93	11,00	8,98	7,57	6,59	5,85	5,45	
580	24,00	16,27	11,26	9,21	7,75	6,76	6,00	5,59	
600	24,42	16,62	11,53	9,42	7,94	6,92	6,14	5,73	
620	24,84	16,96	11,80	9,64	8,14	7,08	6,30	5,87	
640	25,25	17,31	12,06	9,86	8,32	7,25	6,45	6,01	
660	25,66	17,67	12,32	10,07	8,51	7,42	6,61	6,15	
680	26,08	18,01	12,58	10,29	8,70	7,59	6,75	6,29	
700	26,49	18,36	12,85	10,51	8,89	7,76	6,90	6,43	
720	26,89	18,70	13,11	10,73	9,07	7,92	7,06	6,57	
740	27,32	19,04	13,38	10,94	9,26	8,08	7,21	6,71	
760	27,73	19,39	13,64	11,15	9,45	8,25	7,35	6,85	
780	28,14	19,73	13,91	11,38	9,63	8,42	7,50	6,99	

<b>800</b>	28,55	20,08	14,17	11,59	9,82	8,59	7,66	7,13
<b>850</b>	29,57	20,94	14,83	12,12	10,29	9,00	8,03	7,47
<b>900</b>	30,61	21,80	15,48	12,66	10,75	9,41	8,41	7,82
<b>950</b>	31,63	22,66	16,14	13,21	11,22	9,82	8,78	8,17
<b>1000</b>	32,67	23,52	16,79	13,74	11,69	10,25	9,17	8,52
<b>1050</b>	33,68	24,39	17,45	14,28	12,15	10,66	9,54	8,86
<b>1100</b>	34,69	25,23	18,11	14,81	12,61	11,07	9,92	9,21
<b>1150</b>	35,73	26,08	18,76	15,35	13,08	11,48	10,29	9,55
<b>1200</b>	36,75	26,95	19,40	15,88	13,53	11,89	10,65	9,90
<b>1250</b>	37,77	27,80	20,06	16,42	14,00	12,30	11,03	10,24
<b>1300</b>	38,78	28,65	20,71	16,95	14,47	12,72	11,40	10,59
<b>1350</b>	39,80	29,51	21,36	17,49	14,92	13,13	11,78	10,93
<b>1400</b>	40,81	30,35	22,00	18,02	15,39	13,54	12,14	11,28
<b>1450</b>	41,81	31,20	22,65	18,54	15,85	13,95	12,51	11,61
<b>1500</b>	42,84	32,05	23,31	19,08	16,31	14,35	12,89	11,96
<b>1550</b>	43,84	32,90	23,95	19,62	16,76	14,76	13,25	12,30
<b>1600</b>	44,86	33,75	24,59	20,14	17,22	15,16	13,63	12,65
<b>1650</b>	45,86	34,60	25,24	20,67	17,68	15,58	13,99	12,98
<b>1700</b>	46,86	35,43	25,88	21,19	18,14	15,98	14,36	13,33
<b>1750</b>	47,88	36,27	26,53	21,73	18,59	16,39	14,73	13,66
<b>1800</b>	48,87	37,11	27,17	22,26	19,05	16,79	15,09	14,01
<b>1850</b>	49,88	37,95	27,81	22,78	19,50	17,19	15,47	14,34
<b>1900</b>	50,89	38,80	28,44	23,30	19,95	17,59	15,82	14,69
<b>1950</b>	51,89	39,62	29,09	23,83	20,41	17,99	16,20	15,02
<b>2000</b>	52,88	40,46	29,73	24,36	20,86	18,41	16,56	15,37

## Furniture Manufacturing supplement - Income statement and balance sheet

<b>Income statement</b>	
<b>Financial year 2004</b>	
<b>(Figures in 1000 €)</b>	
Sales	4 504
Cost of goods sold	3 275
Gross profit	1 229
General operating expenses	174
Depreciation	290
Operating income	765
Other income	23
Earnings before interest & tax	788
Interest expense	186
Net profit before tax	602
Taxes (28%)	169
Net profit after tax	434

<b>Balance sheet</b>	
<b>December 31, 2004</b>	
<b>(Figures in 1000 €)</b>	
<b>Assets</b>	
<i>Current assets</i>	
Cash and bank	344
Accounts receivable	399
Inventory & WIP	747
Total current assets	1 489
<i>Fixed assets</i>	
Machinery & equipment	819
Land & buildings	1 599
Total fixed assets	2 419
<b>Total assets</b>	<b>3 908</b>
<b>Liabilities &amp; equity</b>	
<i>Current liabilities</i>	
Accounts payable	313
Wages payable	69
Total current liabilities	382
<i>Long-term liabilities</i>	
Bank loan	2 228
Total long-term liabilities	2 228
Total liabilities	2 610
<i>Restricted equity</i>	
Capital stock	214
Reserves not available for distribution	180
Total restricted equity	394
Non-restricted equity	904
Total equity	1 298
<b>Total liabilities and equity</b>	<b>3 908</b>

## Furniture Manufacturing supplement – Retail store data

Location	Store code	Distance Norrköping DC	Distance Grums	Sales 2004 [€]
<b>Grums</b>	<i>N/A</i>	<b>249</b>	<i>N/A</i>	<i>N/A</i>
Borlänge	BRL	259	243	34 870
Borås	BRS	255	241	112 810
Gävle	GVL	279	344	99 630
Göteborg - Frölunda	GFR	319	245	384 500
Göteborg - Partille	GPA	319	232	310 390
Halmstad	HST	339	369	49 630
Helsingborg	HBG	399	446	50 810
Jönköping	JKP	172	267	124 230
Karlstad	KST	225	26	81 600
Linköping	LKP	48	241	195 360
Luleå	LUL	1029	1084	120 190
Lund	LUN	452	494	96 900
Malmö	MLM	459	503	385 930
Norrköping	NKP	5	249	154 500
Skellefteå	SKT	892	947	75 900
Skövde	SKV	211	182	64 070
Stockholm - Johanneshov	SJO	159	341	547 180
Stockholm - Sundbyberg	SSU	166	328	414 930
Sundsvall	SVL	493	549	109 570
Södertälje	STJ	119	294	111 000
Umeå	UME	757	812	130 920
Uppsala	UPP	217	308	470 580
Västerås	VAS	139	233	83 100
Växjö	VAX	278	385	89 340
Örebro	ORE	118	141	168 440
Östersund	OST	672	571	37 810