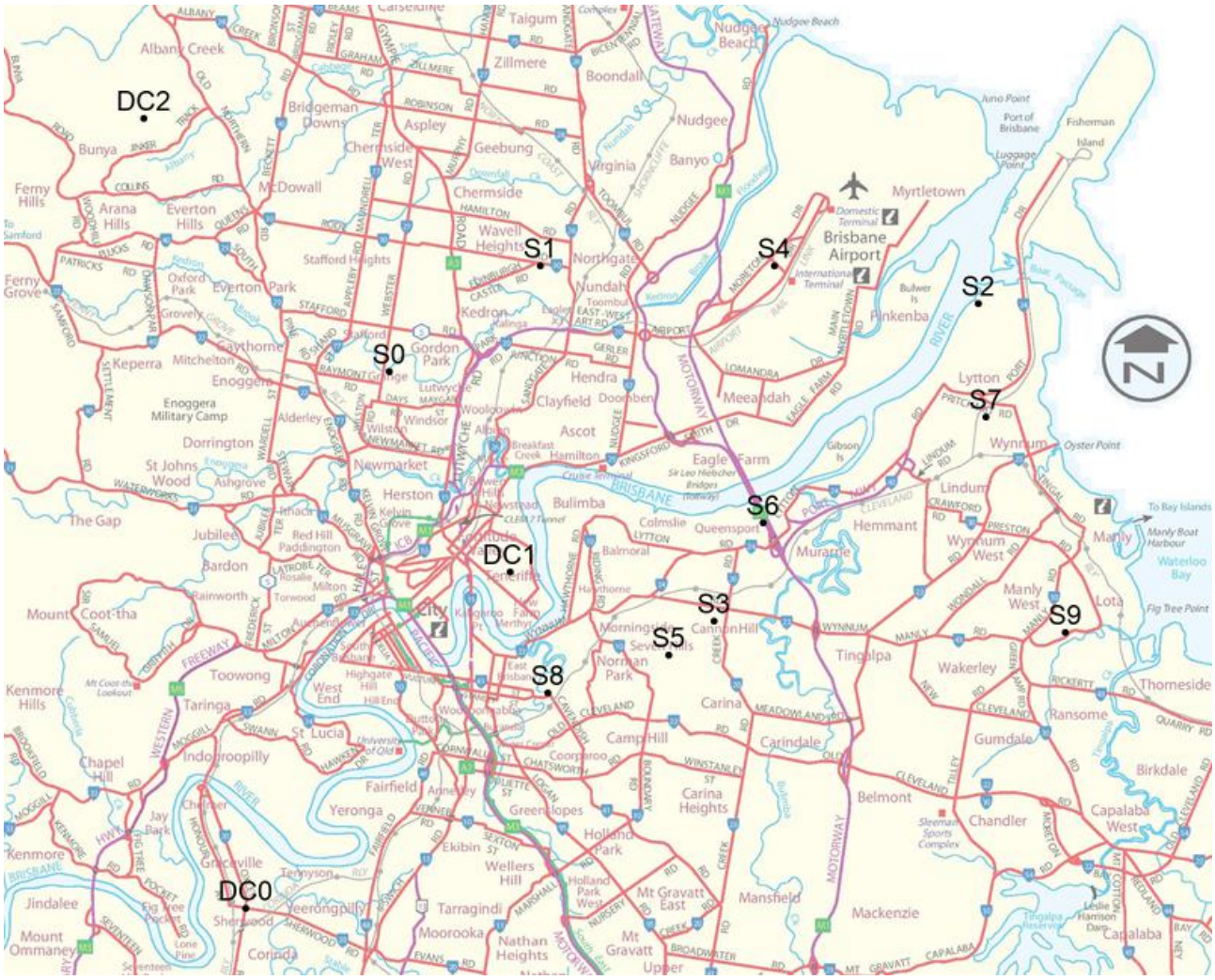
Attention: Amir Rezayan

We are a supermarket chain that wants to improve how we manage the transport of goods from our distribution centres to our stores. We currently have three distribution centres and ten stores, shown in this map:



We have estimated the cost ($) of transporting one truckload from each distribution centre to each store, as given in the following table:

	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
DC0	2081	2462	2958	1911	2735	1805	2139	2795	1456	2707
DC1	1094	1267	1996	1091	1520	1016	1200	1880	912	2100
DC2	1418	1604	2877	2566	2113	2578	2570	2900	2478	3379

The current weekly demand at the ten stores, in truckloads, is as follows:

S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
12	12	10	21	6	10	12	11	8	14

We need to assign each store to one (or more) distribution centres. Please provide us with the optimal transport cost for meeting our demand needs.

$162259

Communication 2

Thank you for your initial assignment of stores to distribution centres. Unfortunately, we've realised that this assignment will not work for us since we have limited capacity at the distribution centres. In truckloads, the capacities at DC0, DC1 and DC2 are 48, 63 and 57, respectively.

Could you revise your assignment of stores to distribution centres to take this into account? Please provide us with the optimal transport cost for meeting our demand needs.

$187388

Communication 3

One of our managers has pointed out that our two distribution centres on the north side of the river actually share a labour pool. Although each centre has reasonable capacity, the maximum we would be able to get through both centres in a week is only 88 truckloads.

Could you revise your assignment of stores to distribution centres to take this into account? Please provide us with the optimal transport cost for meeting our demand needs.

$188368

Communication 4

Thanks for your updated assignment of stores to distribution centres. It is looking great for our current demands and capacities. However, we are concerned about whether the assignment will be robust if we have any surges in demand at our stores. We've looked at our sales history and have developed the following five scenarios that we'd like to be able to handle.

Scenario	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
0	13	12	10	21	23	10	12	11	8	14
1	12	12	10	21	6	10	12	12	8	25
2	12	12	10	21	18	10	12	15	8	14

3	12	12	10	30	16	10	12	11	9	14
4	12	12	10	21	6	10	12	31	8	14

Will your suggested assignment of stores to distribution centres be able to cope with all of these? If not, could you develop a revised assignment that optimises for our current demand but which will also be able to meet demand in these five surge scenarios? Please provide us with the optimal transport cost for meeting our demand needs.

$198518

Communication 5

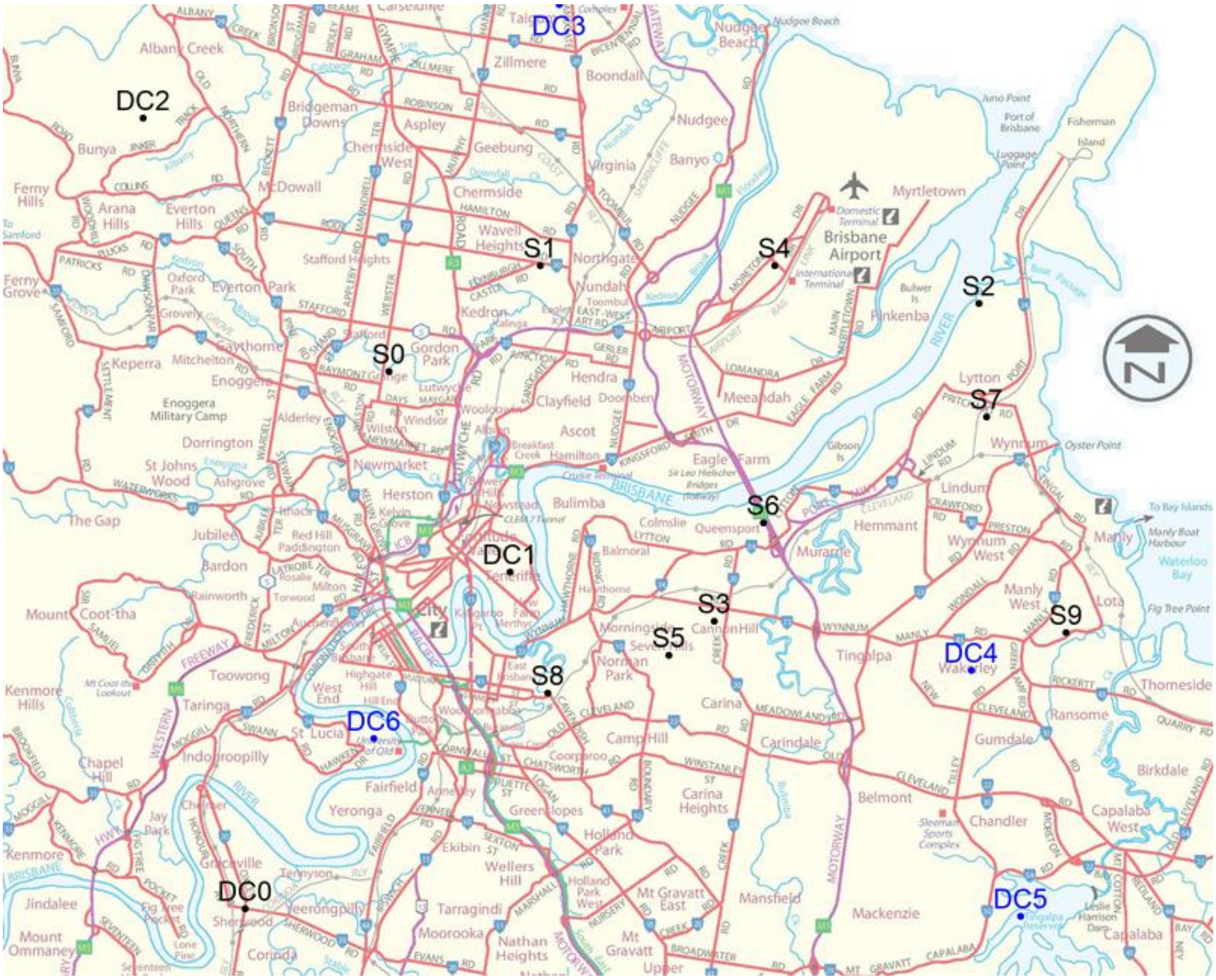
Thank you for your help so far with improving how we manage the transport of goods from our distribution centres to our stores. Based on the savings, we're now looking at options for building new distribution centres and how we might also improve the management of our labour teams. From now on, you can ignore our earlier requirement that limited the labour pool on the north side of the river.

First of all, it would be easier if we assigned each store to just one distribution centre, while still accounting for the surge scenarios. Please provide us with the optimal transport cost for meeting our demand needs.

$201551

Communication 6

We are looking at establishing a new distribution centre from the four candidate sites shown in blue on the map below:



The estimates transport costs per truckload from these potential sites to our stores are shown in the table:

	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
DC3	1506	1146	1945	2241	1371	2304	2020	2147	2423	2654
DC4	2321	2105	1381	1096	1774	1255	1152	1077	1542	716
DC5	2766	2752	2059	1588	2391	1641	1674	1772	1804	1181
DC6	1469	1802	2505	1550	2107	1389	1714	2370	1087	2392

The capacities of the new sites would be 19, 45, 77 and 77, respectively.

We would like to know how much a new distribution centre would reduce our weekly transport costs so we can decide on its viability. Please provide us with the optimal transport cost for meeting our demand needs.

$149892

Communication 7

Could you investigate if we should actually close one of our existing distribution centres and open two of these new sites as distribution centres instead?

Please provide us with the optimal transport cost for meeting our demand needs.

$145030

Communication 8

We want to also consider labour costs when making our decision. For each distribution centre used, we need to know the number of full time and part time teams to assign to it. A full time team costs $4,500 per week and a part time team costs $2,750 per week. A full time team can process 9 truckloads per week and part time team can process 5 truckloads per week. Could you create a new plan that tells us which distribution centres to use, the assignment of supermarkets to distribution centres, and the teams to assign at each distribution centre? You only need to assign enough labour to handle the base demand (not the surge scenarios).

Please provide us with the optimal total of transport and labour costs for meeting our demand needs.

$206530

Communication 9

We have realised that the variations in transport cost and labour demand caused by surge weeks may be significant and we would like you to consider this in the planning process. We have calculated the frequency, in weeks per year, of each of the surge scenarios, as shown in the following table:

Scenario	**0**	**1**	**2**	**3**	**4**
Weeks	3	1	5	6	3

The remaining 34 weeks of the year will have the standard demand pattern.

As well as full time and part time employees, who are employed for all 52 weeks, in order to cover the processing labour in surge weeks we make use of casual employees. Each casual employee can process one truckload in the week and costs $2080 per week, but only needs to be employed for the surge weeks they are used.

Please prepare an optimal plan for the whole year and provide us with the total transport and labour costs.

We look forward to reading your final report.