

MEMORANDUM

Date: February 22, 2006 (*Resubmitted April 24, 2006*)

Subject: Car Wash Capacity Analysis

To: Matt Ford

From: Chris Godwin

Introduction

As requested, a capacity analysis was conducted on the car wash. Both one and two wash line options were taken into consideration during the analysis, along with the average demand, revenue, and cost information provided by the manager.

Findings

Capacity. Based upon the design capacity of 15 cars per hour per wash line, and the manager's projected average demand of between 14 and 18 cars per hour; one wash line is the recommended choice for the car wash. One wash line would produce a profit of \$7,275 at the full 15 car capacity (which is within our projected demand range). It would take 20 cars to reach roughly the same profit with two wash lines (which is outside of our projected demand range). See Table 1.

Break-Even. With one wash line, the break-even point where revenue equals expenses is roughly 6.8 cars per hour. With two wash lines, the break-even point increases to roughly 11.9 cars per hour. See Table 2.

Improvement Opportunities. If the selling price could be increased from \$5.95 to \$8.95 per car through positive word of mouth, and the variable costs could be decreased from \$3.00 to \$2.00 per car from the installation of the new washing technology, the recommendation would be two wash lines. The new break-even point would drop to 5.1 cars per hour, a "safer" break-even volume than the 11.9 cars per hour. See Table 2.

Discussion

Method. The main assumption is that the average demand is between 14 and 18 cars per hour based upon the manager's calculations. A profit and break-even equation were used to calculate the figures. A comparison of the profit schedule and break-even points of each wash line option in each scenario is given.

Capacity. Table 1 shows a profit schedule comparing the two wash line options. Since 15 cars per hour is the design capacity of one wash line, the profit will max out at \$7,275. If a second line is added, the design capacity is expanded to 30 cars per hour, but that volume greatly exceeds the expected demand. A profit of \$7,200 can be achieved with two wash lines, but it takes more volume (5 more cars per hour). If the average demand is held to between 14-18 cars per hour, a single car wash line is optimal for maximum profit.

Table 1: Profit Schedule Per Month

Cars per hour		1 Car Wash Line			2 Car Wash Line		
		<u>Revenue</u>	<u>Cost</u>	<u>Profit</u>	<u>Revenue</u>	<u>Cost</u>	<u>Profit</u>
Average Demand	14	\$24,990	\$18,600	\$6,390	\$24,990	\$23,100	\$1,890
	15	\$26,775	\$19,500	\$7,275	\$26,775	\$24,000	\$2,775
	16	Beyond Capacity			\$28,560	\$24,900	\$3,660
	17	Beyond Capacity			\$30,345	\$25,800	\$4,545
	18	Beyond Capacity			\$32,130	\$26,700	\$5,430
	19	Beyond Capacity			\$33,915	\$27,600	\$6,315
	20	Beyond Capacity			\$35,700	\$28,500	\$7,200
	21	Beyond Capacity			\$37,485	\$29,400	\$8,085

Calculation: Profit = Revenue - Costs; Revenue = \$5.95 x cars per hour x 300 hours per month.

Cost = Fixed Cost (\$6000-1 line or \$10,500-2 line) + \$3 x cars per hour x 300 hours per month.

Source: OM textbook for calcs, car wash manager for revenue and cost variables.

Break Even: Table 2 shows the volume needed with each wash line option to break even. Although with two wash lines the break even point (roughly 12 cars per hour) comes before the low end of the expected average demand, it appears uncomfortably close to that range. The single wash line will allow a larger “cushion” between the break-even point (roughly 7 cars) and the expected average demand of 14 to 18 cars per hour. The greater the “cushion”, the more likely it is that a more consistent profit flow for the car wash operation will be realized.

Table 2. Break Even Volume (cars per hour)

	Wash Lines	
	1	2
Original Variables (Revenue \$5.95/car, Variable Cost \$3.00/car)	6.8	11.9
Positive Word of Mouth Price Increase & Lower Cost from New Washing Technology (Revenue \$8.95/car, Variable Cost \$2.00/car)	2.9	5.1

Calculation: Break Even = [Fixed Costs/(Rev per car - Var Cost per car)]/300 hrs per month

Source: OM textbook for calcs, car wash manager for variables

Improvement Opportunities (Break-Even) Table 2 also shows that if the selling price could be increased with positive word of mouth advertising, and if the variable costs could be decreased with new washing technology, then a two wash line option looks increasingly preferable. Both wash line options produce a lower break-even point with the new scenario. But the two car wash line has a break-even point that is below even the one car wash line option from the original scenario.

Improvement Opportunities (Capacity) A new profit schedule using the new optimistic variables is shown in Table 3. The profit will max out at about \$25,300 with one car wash line. The two wash line does produce a higher profit of about \$27,000 that is still within our projected average demand. However, unless the car wash operates consistently at the high end of the projected average demand (18 cars per hour), the profit of the one car wash line would be more stable. On the other hand, the flexibility of the two wash line to handle increased demand in the future may be worth investing in it now while startup costs are minimal compared to adding a second wash line in the future.

Table 3: New Scenario Profit Schedule Per Month

Cars per hour		1 Car Wash Line			2 Car Wash Line		
		Revenue	Cost	Profit	Revenue	Cost	Profit
Average Demand	14	\$37,590	\$14,400	\$23,190	\$37,590	\$18,900	\$18,690
	15	\$40,275	\$15,000	\$25,275	\$40,275	\$19,500	\$20,775
	16	Beyond Capacity			\$42,960	\$20,100	\$22,860
	17	Beyond Capacity			\$45,645	\$20,700	\$24,945
	18	Beyond Capacity			\$48,330	\$21,300	\$27,030
	19	Beyond Capacity			\$51,015	\$21,900	\$29,115
	20	Beyond Capacity			\$53,700	\$22,500	\$31,200

Calculation: Profit = Revenue - Costs; Revenue = \$8.95 x cars per hour x 300 hours per month.

Cost = Fixed Cost (\$6000-1 line or \$10,500-2 line) + \$2 x cars per hour x 300 hours per month.

Source: OM textbook for calcs, car wash manager for new revenue and cost variables.

Limitations: All calculations are based on the car wash manager’s estimated demand of 14 to 18 cars per hour. If these numbers are not realized, then there will be problems achieving the desired profit. Conversely, if the estimates are on the low end, and there ends up being more demand than originally expected, the car wash could be missing out on maximum possible profit with only one wash line. With two wash lines, the risks associated with not always making the most profit may be outweighed by the security of knowing that the car wash can handle more capacity when most demanded.