



ZEYNEP TON

IBM Retail Business Assessment at Dillard's, Inc.: Managing Staffing Levels to Improve Conversion

"These results look very promising for retailers," said Don Bauer a business consultant with IBM Software Group, to colleague Chris Carlson. Using a new video-mining technology developed by IBM called the Smart Surveillance System, they had collected 12 weeks of store-traffic data at a Texas location of Dillard's, Inc., a large department store chain in the United States. "Look at all the variation in conversion rates over time and the relationship to staffing levels. That means there are things this store can do to increase sales."

"Matching staffing levels to store traffic and sales clearly shows an opportunity for retailers to modify their staffing to more effectively take advantage of when consumers are shopping in the stores," Carlson responded. "We're always telling retailers they're leaving a lot of money on the table by staffing their stores according to sales and ignoring traffic. This time, we have the data to show it."

Dillard's, Inc.

Dillard's, Inc. was founded in 1938 by William T. Dillard. Almost from the beginning, the retailer had a reputation for providing attractive prices and credit to customers with middle to upper-middle incomes. Dillard's first mall-based store, opened in 1964, was a success and, by January 2009, most of Dillard's 315 department stores in the United States were in suburban shopping malls. In 2008, Dillard's generated \$6.8 billion in sales and employed about 49,900 employees, 33% of whom worked part time. The stores carried a wide range of brand-name and private-label clothing, accessories, shoes, cosmetics, and home furnishings. Dillard's competitors included JC Penney, Macy's, and Nordstrom's (see **Exhibit 1** for a comparison).

Managing a Dillard's Store

Stores were managed by store managers and their salaried staff. Each month, store managers received sales and profitability targets from corporate headquarters, but each store manager used his or her own experience and intuition to decide how to manage store processes, how to allocate staff to tasks, and how much to pay sales associates in order to achieve those targets.ⁱ

ⁱ Decisions related to merchandising (assortment, inventory levels, pricing), store layout, organization of backrooms, and incentive plans for sales associates were made by corporate. Corporate also sent store managers planograms that described how particular departments should be laid out.

An operations manager assisted the store manager in all aspects of store operations. The operations manager spent most of her time on the selling floor. She monitored sales transactions, returns to vendors, store presentation, and adherence to employee schedules and dealt with employee tardiness and absenteeism.

Stores were divided into areas (or departments), each with its own point of sale device. A typical store employed about 150 hourly sales associates. Those working in shoes, mens suits, and furniture received a sales commission, which was higher for the newest merchandise received. All other sales associates received an hourly salary, which was based on a certain productivity level set by the store manager. The productivity level varied by area within a store. For example, an associate who started at \$9 per hour might be expected to sell on average \$100 worth of merchandise per hour, while one who started at \$10 per hour might be expected to sell on average \$120 worth of merchandise per hour. A new sales associate's productivity was reviewed after his or her third month and then annually thereafter. If sales associates did not meet their productivity targets, their hourly pay could be adjusted. If they exceeded their targets, their pay increased—along with their productivity targets.

A Typical Day at the Store

Depending on a store's size, deliveries could be received almost every weekday to weekly from Dillard's distribution centers. A truck would arrive during the night to drop off a trailer filled with merchandise and remove an empty trailer. The receiving manager arrived before 7 a.m., opened the store for housekeeping, and started unloading the truck and checking the accuracy of the shipment. Meanwhile, housekeeping cleaned the store and, around 10 a.m., started processing the new delivery, which included opening boxes, removing plastic from items, and changing hangers. By noon or 1 p.m., new merchandise was ready for the selling floor.

The first shift of sales associates arrived at 9:50 a.m., 10 minutes before store opening, to open their registers. Their day began with a meeting with their area sales manager where they discussed previous area performance to date, sales targets, promotions and sales activities. Between 10 a.m. and noon, they assisted customers, organized the merchandise in their areas, and called clients to inform them of upcoming sales or special events. After noon, sales associates began shelving the new merchandise for their areas that had been unloaded that morning. At least twice a week, sales associates worked on markdowns, which involved scanning and then re-ticketing merchandise; stores received that list of items that needed to be marked down from corporate. Although the number of units to be marked down in a day could range from a few to over 10,000, sales associates tried to complete the markdown list before the store closed.

With the exception of shoes almost all inventory was presented on the selling floor and sales associates spent all their time there. Those working in the shoe department also spent considerable time in the stockroom organizing inventory and locating shoes that customers had requested.

Dillard's Store in Arlington, Texas

IBM and Dillard's joint Business Value Assessment (explained in full below) was conducted at a Dillard's store in an Arlington Texas shopping mall. (see **Exhibit 2** for demographics in this area). The mall hosted over 180 stores, including four department stores—Dillard's, Macy's, JC Penney, and Sears (see **Exhibit 3** for the mall layout). It also hosted an 18-screen AMC theater, an ice-skating arena, and a food court. The mall was open from 10 a.m. to 9 p.m. Monday - Saturday and from noon to 6 p.m. on Sundays.

This Dillard's store employed 165 hourly sales associates, each assigned to one of the 10 areas. Each area was managed by an area sales manager who was responsible for recruiting and scheduling sales associates. Full-time sales associates typically worked 35-39 hours a week; part-time sales associates typically worked 25-28 hours a week, often in the evenings from 6-9 p.m. and all day during weekends.

Store traffic varied greatly throughout the week. Jim Mount, who had 33 years of experience managing 12 stores, commented:

During a typical day, traffic builds up until late afternoon and then drops again. We can't convert all traffic into sales for various reasons. Some people come to the store with the mission to purchase something, but can't complete their mission because we don't have what they are looking for or we don't give them the customer service they need or because our price is too high. There is also another set of people who come to the store without a mission, especially on Saturdays and Sundays and sometimes between 1 and 4 p.m. on weekdays. They come to the store just to spend time. In terms of conversion rate, our most productive times are probably between 11 a.m. and 12 p.m. and between 8 p.m. and 9 p.m.

Scheduling Sales Associates

Most retailers in the United States scheduled their hourly associates one or two weeks in advance. Dillard's area managers scheduled their sales associates one month in advance for an entire month. For example, the schedule for July 2009 was prepared the beginning of June 2009. As Mount explained: "Nothing happens within two weeks that would cause us to change our schedules a lot. We make so many demands and expectations of our people that giving them their schedules one month in advance is one way we help them."

Two weeks before the schedules were due, Mount emailed his area managers information about upcoming events and holidays and about scheduling and vacation policies. Area managers then gave their sales associates a week to provide their availability for the month, which the area managers took into account. It often took the area managers a few days to create their schedules. Mount then met with each area manager for at least an hour to go over his or her schedule.

Area managers determined staffing levels using the internally developed Manpower Management System (MMS). For each area within each store, MMS calculated weekly staffing levels using the expected sales and the expected sales per hour of labor for that particular week. MMS then converted the weekly staffing levels into hourly staffing levels and provided each area manager with a recommendation, which often included the minimum coverage required for each hour. If an area manager's schedule deviated too much from the MMS recommendation, he or she either had to provide a good justification to Jim Mount or else make the schedule more consistent with the recommendation.

Industry Business Value Assessment Group at IBM

Don Bauer and Chris Carlson were members of IBM's Industry Business Value Assessment (IBVA) team, which was part of IBM Software Group Americas. The IBVA team focused on developing business cases for clients in major industries (Financial Services, Industrial, Distribution, Healthcare, and Public). The goal of an IBVA, a pre-sales offering from IBM, was to apply strong industry subject matter expertise and guidance to help customers define, understand and maximize the business value of IBM technology solutions. The team engaged with client executives and staff from both business and technology functions to understand business problems, propose solutions, and build a return on investment business case along with a roadmap for deploying the solution.

IBVAs ranged from high-level solution design to the development of an advanced return-on-investment analysis. They were structured and led by an IBVA consultant and typically lasted four weeks. IBM offered prospects and clients IBVAs free of charge, in exchange for participation by the business (including senior executives) and a commitment to invest staff time in the process and to evaluate and consider the results.

Bauer had spent 26 years with IBM, had deep knowledge of the technologies developed by IBM for the retail industry, and an innate ability to match those technologies to retail processes thereby maximizing business value. Before joining the pre-sales group in 2004, he had spent eight years in sales working on retail and distribution accounts. Carlson was an expert in the retail industry. He spent more than 10 years working for Gap, Limited and American Eagle Outfitters as a merchant and had been a retail consultant for five years before joining the IBVA team. In early 2008, Bauer and Carlson had come to Dillard's to test a new technology which IBM felt might be useful to the retail industry and which Dillard's management hoped would help improve store operations.

The Smart Surveillance Solution

In 2003, IBM developed technology to help companies extract more value out of the video content they were capturing from surveillance cameras. The smart surveillance solution (S3) fed multiple streams of video through a server that analyzed them in real time to build out meta data. With this meta data, the video could then be analyzed like a large relational data base. The data resulting from this analysis allowed for the analysis of camera images. S3 thus allowed companies to integrate data from multiple cameras into one searchable system, search the data according to a wide range of parameters (e.g., time, object size, and color), and analyze footage to identify particular people or particular patterns of behavior. In the retail industry the S3 solution could be used to count traffic in and out of the store and departments and to provide retailers with loss prevention, operations and merchandising and marketing benefits.

Some retailers were already using videos or counting systems at their stores, but most of these technologies did not have S3's ability to record a customer's directionality. That is, the S3 technology could distinguish between a customer entering the store and a customer leaving the store, whereas typical "people counters" only counted how many people went through a particular doorway in either direction. (Retailers usually divided that number by two to determine how many customers had visited a store, but without counting based on directionality, these other people counting systems lacked granularity for counts less than an entire day, hence if the count were for a period shorter than the whole business day, some customers might have come in but not left yet or might already have been inside before the count began.) More sophisticated technologies that accurately recorded customer's directionality (e.g. ShopperTrack), did not have S3 technology's ability to analyze the video meta data.

Like all early-stage or cutting-edge technologies, S3 had some drawbacks at the point of IBM's initial assessment. For example, it could count the same person multiple times if he or she moved about near the camera. At Dillard's, for example, if a customer moved around the tables with shoe displays, he or she could be counted as entering, exiting, and then re-entering that area. Yet, as the technology would evolve and be used by retailers, new algorithms would develop to overcome weaknesses such as this.

The Results at Dillard's

For the IBM study at Dillard's store in Arlington, Texas, cameras in each store entrance counted people entering the store. Cameras in the perimeter of the shoe department counted the people entering the shoe department. Cameras near escalators measured the flow of people up and down

the escalators. Cameras were mounted in some specific areas to view brands that were particularly likely to be stolen (see **Exhibit 4** for the location of cameras throughout the store).

Bauer's and Carlson's experience in the retail industry had convinced them that one way to increase a store's conversion rate was to modify how it staffed its store to more effectively take advantage of when customer traffic varied during the day and week. Once they had collected 12 weeks of traffic data from video observations, they asked Dillard's to provide them with labor data for the same period.ⁱⁱ They then combined hourly traffic data with hourly sales-transaction data. Their analysis showed exactly what they anticipated—a strong relationship between conversion rates (transactions/visitors) and staffing levels adjusted by traffic (labor hours/visitors) (see **Exhibit 5** for an aggregated version of the data used for this analysis and spreadsheet titled Traffic Data.xls for more detailed traffic data). Bauer and Carlson concluded that Dillard's had a great opportunity to improve sales at its store in Arlington.

"I've seen this over and over," said Carlson. "Retailers just don't have the right number of associates working in their stores at the right times to maximize sales. They keep looking at historical sales to plan their staffing levels and they never see how much they could have sold if they'd had enough people to help the customers, as well as keep up with the re-stocking."

Bauer pointed to their analysis. "It's all right here. If Dillard's could increase its conversion rate by two percent, sales would go up by almost 10 percent. That would be huge." Carlson responded "but it's still not clear what Dillard's should do. If they simply add more labor, there is additional cost. Would that cost be offset by the increase in sales? If they keep the existing labor levels, but use it more intelligently based on traffic, how much incremental sales could they drive?" Bauer responded "A rigorous analysis could help answer these questions. Then there is one other question left for us. How much would retailers be willing to pay for a technology that could provide the data to conduct such an analysis?"

ⁱⁱ Labor data was available for only 9 of the 12 weeks.

Exhibit 1 Comparison of Department Stores

	Dillard's		Kohl's		Macy's		Nordstrom		JCPenney		Bon Ton Stores	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Sales-Net	7,339	6,954	16,474	16,389	26,313	24,892	9,120	8,573	19,860	18,486	3,468	3,225
Comparable Sales (%)	-5	-7	-0.8	-6.9	-1.3	-4.6	3.9	-9	0	-8.5	-6.5	-7.4
Net Sales/Retail Sq Foot	130	128	249	222	170	161	402	388	248	223	133	124
Employees (000's)	49.9	49.9	125.0	126.0	182.0	167.0	55.0	51.0	155.0	147.0	32.7	29.1
Gross Profit Margin	34.7	30.6	36.5	36.9	40.4	39.7	42.4	40.3	38.6	37.4	38.0	36.9
Inventory Turnover	2.7	3.1	3.8	3.7	3.0	3.1	5.4	5.5	3.5	3.4	2.8	2.9
Net Income (Loss)	54	-241	1,084	885	893	-4,803	715	401	1,111	572	12	-170
Total Retail Sq Footage (000's)	56,300	54,200	69,889	74,992	155,200	154,300	20,502	21,876	106,600	109,900	26,000	26,000

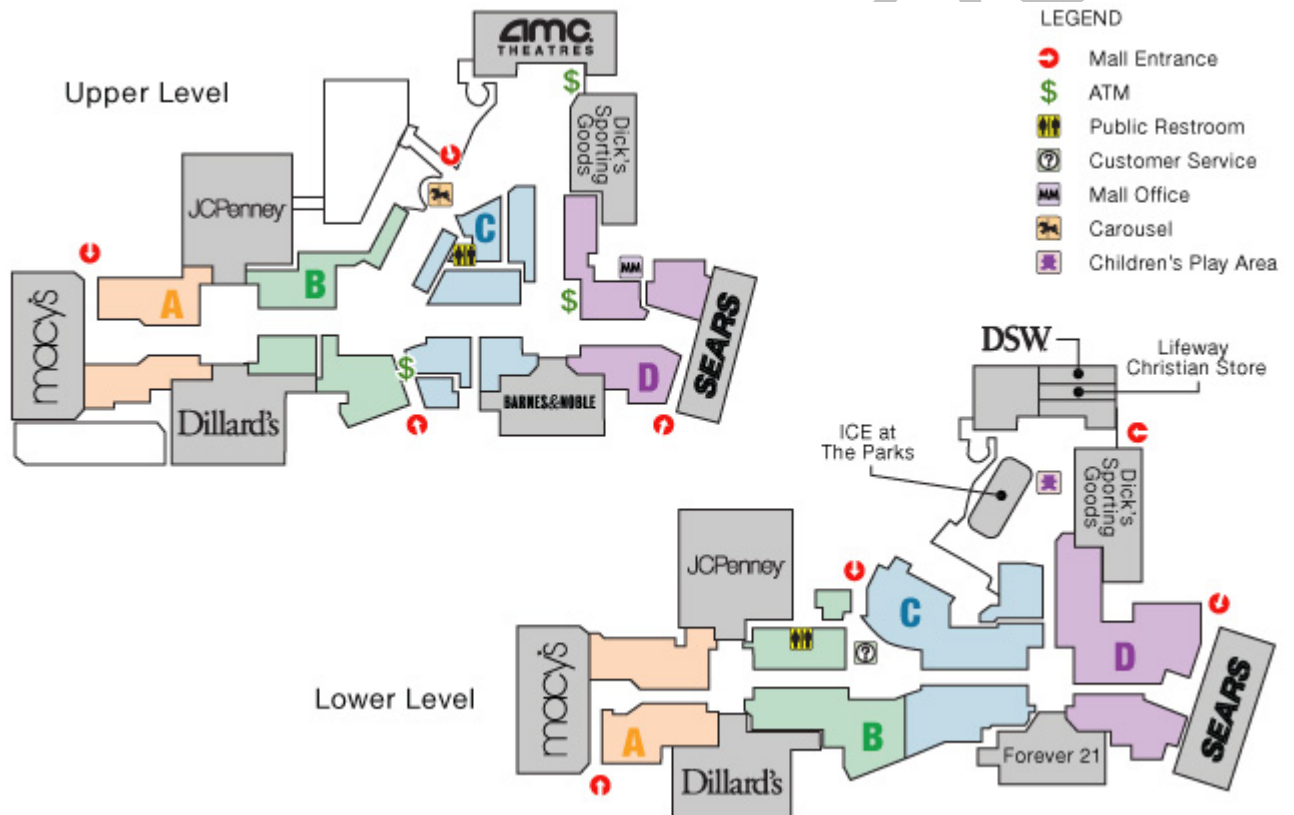
Source: Standard & Poor's Compustat®, accessed November 2009.

Exhibit 2 Comparison of demographics in Arlington, Texas and Tarrant County, Texas, to demographics in the US.**Census 2000 Demographic Profile Highlights:**

General	Arlington, TX		Tarrant County, TX		US
	Number	Percent	Number	Percent	U.S.
Total population	16,063		1,446,219		
Male	7,855	48.9	716,001	49.5	49.10%
Female	8,208	51.1	730,218	50.5	50.90%
Median age (years)	33.2	(X)	32.3	(X)	35.3
Under 5 years	1,130	7	115,118	8	6.80%
18 years and over	12,018	74.8	1,039,747	71.9	74.30%
65 years and over	1,378	8.6	120,585	8.3	12.40%
Race					
One Race	15,705	97.8	1,409,890	97.5	97.60%
White	12,432	77.4	1,030,208	71.2	75.10%
Black or African American	1,622	10.1	185,143	12.8	12.30%
American Indian and Alaska Native	95	0.6	8,300	0.6	0.90%
Asian	739	4.6	52,594	3.6	3.60%
Native Hawaiian and Other Pacific Islander	5	0	2,252	0.2	0.10%
Some other race	812	5.1	131,393	9.1	5.50%
Two or more races	358	2.2	36,329	2.5	2.40%
Hispanic or Latino (of any race)	1,883	11.7	285,290	19.7	12.50%
Economic and social					
In labor force (population 16 years and over)	8,994	72.9	752,129	69.5	63.90%
Median household income in 1999 (dollars)	48,511	(X)	46,179	(X)	41,994
Median family income in 1999 (dollars)	54,966	(X)	54,068	(X)	50,046
Per capita income in 1999 (dollars)	22,007	(X)	22,548	(X)	21,587
Families below poverty level	230	5.3	29,608	8	9.20%
Individuals below poverty level	1,290	8.1	150,488	10.6	12.40%
Population 25 years and over	10,551		898,850		
High school graduate or higher	9,267	87.8	730,928	81.3	80.40%
Bachelor's degree or higher	2,825	26.8	239,285	26.6	24.40%

Source: U.S. Census Bureau.

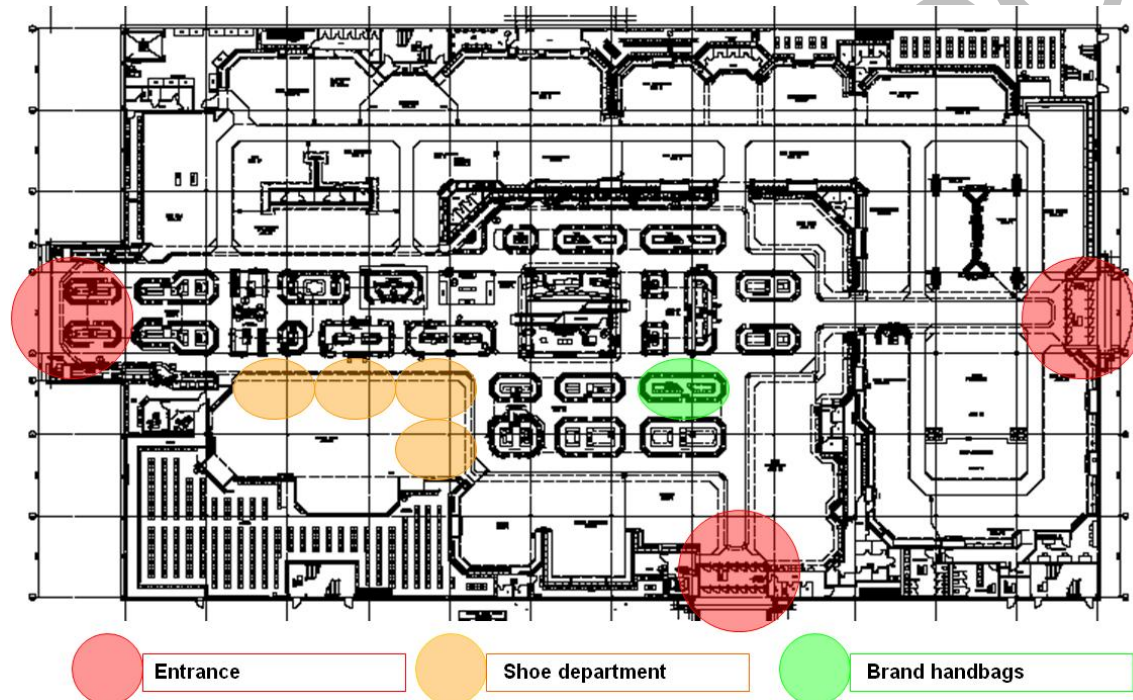
Exhibit 3 Layout of the Park at Arlington.



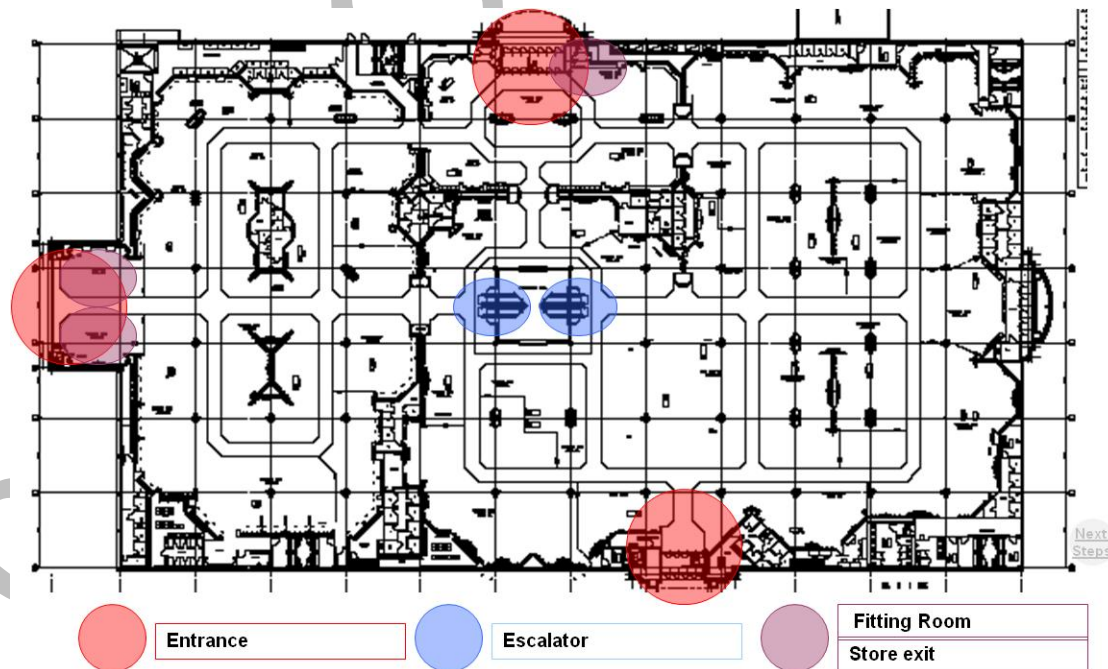
Source: The Parks at Arlington, Directory, The Parks at Arlington Web site, <http://www.theparksatarlington.com/directory>, accessed November 2009.

Exhibit 4 Location of cameras at the Dillard's store.

First floor



Second Floor



Source: IBM IBVA Group.

Exhibit 5 Data collected from the Dillard's store in the Parks at Arlington Mall over 9 weeks from April 2008 to June 2008 aggregated at the day/time level.

Day	Time	Average Labor Hours	Average # of Transactions	Average Sales (\$)	Average # of Visitors	Average Conversion Rate	Average Labor Hours per Visitor
Monday	10-11	82	46.1	4159	321	0.149	0.305
Monday	11-12	84	92.4	7170	414	0.228	0.230
Monday	12-13	96	135.5	10464	554	0.251	0.203
Monday	13-14	95	142.3	12271	624	0.237	0.180
Monday	14-15	92	142.9	12046	640	0.240	0.177
Monday	15-16	97	126.4	10893	616	0.211	0.190
Monday	16-17	97	116.5	9346	620	0.194	0.179
Monday	17-18	93	121.6	10386	593	0.212	0.175
Monday	18-19	76	108.1	7949	558	0.193	0.143
Monday	19-20	74	98.6	8584	548	0.178	0.138
Monday	20-21	65	70.8	5581	361	0.192	0.185
Tuesday	10-11	82	54.7	3432	238	0.231	0.352
Tuesday	11-12	87	87.2	7052	323	0.270	0.269
Tuesday	12-13	102	110.3	8616	407	0.273	0.254
Tuesday	13-14	104	125.7	9352	451	0.280	0.235
Tuesday	14-15	100	118.7	9512	447	0.267	0.227
Tuesday	15-16	101	100.8	8805	419	0.242	0.245
Tuesday	16-17	100	98.7	8353	470	0.212	0.217
Tuesday	17-18	95	107.8	8178	507	0.212	0.194
Tuesday	18-19	87	95.8	8758	486	0.197	0.181
Tuesday	19-20	83	107.4	9144	546	0.197	0.154
Tuesday	20-21	73	91.8	7312	377	0.240	0.199
Wednesday	10-11	83	54.4	4705	264	0.211	0.327
Wednesday	11-12	92	93.4	7690	369	0.253	0.253
Wednesday	12-13	107	115.0	8738	452	0.254	0.241
Wednesday	13-14	101	131.3	9710	525	0.253	0.196
Wednesday	14-15	95	136.4	11468	491	0.281	0.199
Wednesday	15-16	102	116.8	8931	458	0.258	0.232
Wednesday	16-17	100	120.7	9678	527	0.227	0.193
Wednesday	17-18	96	117.4	8804	553	0.214	0.177
Wednesday	18-19	84	134.7	9720	560	0.240	0.155
Wednesday	19-20	80	123.6	10046	553	0.222	0.151
Wednesday	20-21	70	112.8	8141	423	0.271	0.171

Day	Time	Average Labor Hours	Average # of Transactions	Average Sales (\$)	Average # of Visitors	Average Conversion Rate	Average Labor Hours per Visitor
Thursday	10-11	86	56.9	4719	372	0.153	0.243
Thursday	11-12	95	122.2	10298	479	0.254	0.200
Thursday	12-13	109	141.4	11150	538	0.263	0.208
Thursday	13-14	107	150.7	11497	592	0.254	0.182
Thursday	14-15	104	148.1	11304	593	0.253	0.178
Thursday	15-16	107	140.1	10890	589	0.245	0.191
Thursday	16-17	105	127.9	10147	584	0.225	0.186
Thursday	17-18	102	137.9	10569	631	0.223	0.170
Thursday	18-19	89	147.4	12997	662	0.226	0.140
Thursday	19-20	86	128.3	9530	700	0.183	0.127
Thursday	20-21	77	108.8	8311	565	0.205	0.142
Friday	10-11	86	77.7	6264	400	0.205	0.230
Friday	11-12	97	136.2	10263	559	0.252	0.182
Friday	12-13	111	164.0	12893	720	0.228	0.155
Friday	13-14	111	206.6	15894	824	0.251	0.135
Friday	14-15	110	204.7	16221	864	0.238	0.128
Friday	15-16	113	191.3	15069	824	0.235	0.140
Friday	16-17	109	183.2	14102	865	0.212	0.127
Friday	17-18	106	170.7	14017	845	0.204	0.128
Friday	18-19	94	163.9	12128	843	0.195	0.114
Friday	19-20	90	161.6	11703	1051	0.153	0.087
Friday	20-21	78	184.3	13724	825	0.222	0.096
Saturday	10-11	83	103.7	7554	581	0.180	0.148
Saturday	11-12	92	210.9	16100	907	0.236	0.105
Saturday	12-13	129	265.0	19521	1214	0.218	0.108
Saturday	13-14	137	301.6	22596	1502	0.201	0.093
Saturday	14-15	139	340.4	25925	1717	0.199	0.081
Saturday	15-16	139	338.7	24587	1811	0.187	0.078
Saturday	16-17	131	315.9	25073	1774	0.178	0.075
Saturday	17-18	116	295.7	22556	1542	0.192	0.076
Saturday	18-19	93	234.6	18771	1380	0.169	0.068
Saturday	19-20	86	219.4	16540	1289	0.170	0.069
Saturday	20-21	75	200.3	14432	909	0.219	0.085
Sunday	12-13	121	133.1	9837	780	0.169	0.159
Sunday	13-14	115	204.1	17578	1069	0.192	0.109
Sunday	14-15	115	240.5	21492	1378	0.175	0.084
Sunday	15-16	115	241.9	20000	1482	0.164	0.078
Sunday	16-17	113	240.8	20731	1424	0.171	0.080
Sunday	17-18	112	206.3	16010	1065	0.194	0.107

Source: IBM IBVA Group.