COMMERCIAL GENERATION STUDY
PALM BEACH COUNTY, FLORIDA

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May 1993 - February 1995

May 22, 1995

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Commercial Generation Study
Palm Beach County Florida
May 4, 1995

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1.0 Introduction

A twelve month study was undertaken to determine the waste generation characteristics of commercial property in Palm Beach County, FL. This study was required to determine the quantity of commercial solid waste generated and the relative generation rates of various types of commercial property to provide a rational basis for the Solid Waste Authority Annual Commercial Assessment. The bulk of this study was designed and conducted by the Solid Waste Authority from May 1993 through April 1994. The last commercial generation study was completed in April 1991 and prepared by DUS Consultants.

1.1 SWA Assessment Program

The SWA assesses the residents and businesses of Palm Beach County for the cost of solid waste disposal on an annual basis on the property tax bill. Currently the SWA assesses residences for 100% of the annual disposal cost and assesses commercial property for approximately 50% of the annual cost of disposal, the balance being paid through tipping fees.

There are 54 classifications or types of commercial property differentiated by PA code designation. These PA codes are grouped into three categories consisting of low, medium, and high generators. The annual commercial assessment is calculated by multiplying the commercial assessment for the category times the total heated square footage of property. The assessment is driven by the average waste generation per heated square foot of commercial property. The waste generation study is designed to estimate, based on a sampling procedure, the average generation in pounds per square foot of property.

1.2 Study Design and Methodology

In order to calculate the average pounds per square foot of commercial property, three variables were required. These variables included the level of service for each business unit in terms of container size and number of container dumps per week, the average quantity of waste in the container at the time of collection expressed as a percentage of maximum container volume, and the average density of waste in the container specified in pounds per cubic yard.

1.2.1 Desired Sample Size

A schedule of the number of commercial entities by PA code (business type) was provided by SWA Customer Information Services based on the commercial tax roll. A goal of a 10% sample size for each PA code was established. The target population for the data collection is defined as all commercial property in Palm Beach County. The sample population was confined to commercial parcels containing only one business entity (single unit parcels) because of the difficulty in apportioning generation to specific businesses when they share a container.

The selection process was largely non-random, however waste generation characteristics were not a determining factor when selecting one parcel over another. The primary factors that resulted in a parcel not being considered were multi-unit parcels and the existence of unique collection methodologies which could pose operational problems, such as rear-load dumpsters which could not be weighed. There is no reason to believe that the statistical properties of the sample differ from the population as a result of the above restrictions.

1.2.2 Level Of Service

In order to determine the service level for each business unit, CIS contacted each commercial entity in the commercial sample to determine the size of their container and the number of times per week it was serviced. The responses were cross-checked with data provided by the hauler to ensure maximum accuracy.

1.2.3 Percentage of Maximum Container Volume

Using the container size and weekly services to determine generation would overstate generation because the container isn't always full. In order to solve this problem, each container was visited once per month just prior to the scheduled collection time to determine the percent full. CIS personnel measured the container volume and the waste volume to determine the percent full. It was hoped that twelve monthly observations could be taken for each container to allow for the calculation of generation at the parcel level, however, because of difficulty in scheduling and because containers were often reached after being dumped by the hauler, this was not possible.

1.2.4 Average Waste Density

The Authority bills based on weight, not volume. Volume measures are converted to weight measures using the average density of commercial waste as a conversion factor. The Authority currently uses an average density of 134 pounds per cubic yard, as was determined in the initial study. Each container was weighed twice using a scale equipped front-end loader collection vehicle, once empty and once with waste in it. The waste volume (% full) was noted when the container was weighed with waste in it. The average density was calculated by subtracting the empty weight from the full weight and dividing by the adjusted volume (size x % full). This procedure proved extremely difficult in the study due to the difficulty in getting to the containers when they were empty. The effort was made easier when a decision was made to actually dump the waste, allowing both weights to be determined at the same time, although at some cost to the Authority.

The only exception to the above procedure was in the case of containers that could not be serviced using a front-end loader, which were primarily smaller plastic garbage cans ranging in size from 13 gallons to 95 gallons. The empty weights were determined by weighing one container of each size at a local home store to determine the empty weight. This procedure was deemed acceptable because the weight of these containers does not vary significantly, while the weight of steel dumpsters of the same size can vary widely due to differences in the gauge of the steel, the configuration, the lid material, and the number and size of welds used to repair or rebuild the container. The weights of the small plastic containers are assumed as follows:

13 gallon	3 lbs	20 gallon	4 lbs
30 gallon	6 lbs	32 gallon	6 lbs
35 gallon	7 lbs	40 gallon	8 lbs
45 gallon	10 lbs	95 gallon	37 lbs

1.2.5 Data Compilation

All collected data was hand recorded on route sheets and transferred to the Solid Waste Authority computer

system for storage and retrieval.

1.3 Data Review

The study data was reviewed to identify outlyers and determine what special circumstances, if any, might unrealistically skew the results. The following is a description of special circumstances or irregularities with the data and the means used to address the potential impact. Other than the decrease in the sample size that resulted from the elimination of some PCN's, the corrective actions highlighted below did not have a material negative impact on the results, but alternatively, these actions resulted in a decrease in the potential for error by preventing the need to make additional assumptions.

1.3.1 Partial Information

In some circumstances, PCN's selected to be included in the study ultimately were not studied because information on their level of collection was not available. This resulted from a number of reasons, including lack of knowledge on the part of the business owner regarding the frequency of collection, inaccessible containers, special collection requirements, or a combination of the above. In the case where key data was unavailable, these units were eliminated from the study. If a PCN was eliminated from the study due to level of service irregularities but valid waste density or percent container volume data was available, the partial information was used for those components of the study.

1.3.2 Non-Generators

Fifty units in the study reflected their level of service as being zero, meaning that they did not generate waste. These PCN's represented primarily storage facilities and garages, but also included a t-shirt shop that reuses cardboard boxes to ship orders. These units were left in the study as they represent a legitimate class of non-generators that reduce the average generation rate, the absence of which would inflate the average generation rate. Although the data from these units is obviously limited to the container size and collection frequency and thus cannot be used for average density and average percent container volume calculations, it can and is used to estimate average generation.

1.3.3 Changes in Container Size and Collection Frequency

As a normal course of business or as a result of a change in ownership, container sizes or collection frequencies changed for some PCN's during the study period. When these changes were noted, a notation was made in the file to reflect said change, however, the data record was not modified. Based upon a review of these notations, the data has been edited to reflect these changes. This editing affected the annual gross generation estimate only.

1.3.4 Going Out of Business

Several businesses ceased operation during the study, requiring the volume testing to be stopped. For the purpose of the generation estimate, these units have been retained in the study, as has all data collected to the time of the realization that business has ceased. The total estimated generation was adjusted to account for the vacancy through pro-ration.

1.3.5 Shared Containers

In some circumstances, several businesses shared a container. In many cases, these businesses were in the same PA code and, rather than eliminate these units from the study, the container was apportioned between the two businesses. For example, if a 4 cubic yard container was shared by two retail stores, it was reflected in the study as two 2 cubic yard containers. For the density calculation, the weights were split between the two PCN's. For the percent full calculation, the observations for the two businesses are the same. This treatment does not impact the results of the study because in all cases weighted average summaries are used as opposed to unweighted averages. In other words, the total generation for the PA code is divided by the total heated square feet for the PA code and neither of these variables is changed by this adjustment.

1.3.6 Compactors

Many businesses, particularly larger businesses such as grocery stores and department stores use compactors. Compactor units require a different treatment for several reasons. First, their overall cubic yard generation is skewed because the waste is compacted. Second, the frequency of collection is not specific as most compactors are serviced on an on-call basis. Third, the average density is greater than that for uncompacted waste. The Authority contacted the haulers, provided them with a list of businesses and requested that they provide the total pounds of waste generated from May 1993 to April 1994 for each business. These responses were incorporated into the study when available.

In other cases, the volume of the container was multiplied by a factor of 3 to account for increased compaction. Although compactor density is variable, the recognized industry average is 3-4 times uncompacted waste. Using a 3:1 ratio is conservative, but nonetheless is a potential source of error. In recognition of this, for all PA codes with PCN's receiving compactor service, summary statistics for the compactor units were compared to summary statistics for both the category and the noncompactor units. In cases where a significant difference was noted between the two groups, the compactors and the PCN's were eliminated from the study. The PA codes affected and the number of PCN's eliminated were restaurants(18), fast food restaurants(11), bars/nightclubs(1), garages(1), vehicle sales/repair(1), and clubhouses(1).

1.3.7 Hospitals with Incinerators

Subsequent to the initial data collection period, the Authority undertook a study of three hospitals in the county which use incinerators to reduce/dispose of medical and other waste in order to determine if the waste generation characteristics differ significantly from other hospitals. The results of the study indicated that hospitals with incinerators do dispose of less waste and, therefore, these hospitals have been moved to a category of their own. This report incorporates the results of this study. The study was carried out over a four month period and the results annualized using the seasonality ratios presented in the report. The net weight of waste and percentage volume were determined for a one week period in each month for Bethesda and St. Mary's hospitals. Because JFK Hospital uses a compactor, the waste could not be collected and weighed by the Authority. In its place, Authority scale records were used. Since JFK hauls its own waste to the Authority, the truck numbers associated with JFK were used to determine the annual generation over the period from October 1993 to September 1994. The total waste quantity for all three hospitals was divided by the total square footage of all three hospitals to determine the annual generation rate. The net weights and percentage volumes for Bethesda and St. Mary's were used to calculated the average density of waste for the category.

2.0 Data Summary

Each data record is comprised of the PCN number, PA code, container size in cubic yards, frequency of collection in times per week, percent full at time of density calculation, net weight of waste for density calculation, the average density of the waste, a varying number of percent values representing the percent volume of waste in the container, and the heated square footage of the property.

2.1 Data Compilation Methodology

Several options were available to compile the data. The basic procedure was to first multiply the container size times the number of pickups per week times 52 weeks to obtain the annual gross generation. Second, the gross generation was adjusted downward using the average percent full to produce the annual net generation in cubic yards and divided by the heated square feet to determine the net generation in cubic yards per square foot. Because the Authority bills by tonnage, not volume, the result was then multiplied by the calculated density to produce the average pounds per square foot.

2.1.1 Average Percent Full

Three measures of the average percent full at the time of collection were available from the study: The average of the percent full measures for each PCN, the average of the percent full measures for each PA code, and the average for the entire sample. Due to seasonality and the inconsistency in the number and timing of the percentage readings for each PCN across the study, using the specific values for each PCN would inaccurately predict the adjusted annual generation. Although the average percent full values vary by PA code, this variance is most likely due to random error, rather than any inherent waste generation differences. For these reasons, the average for the entire sample is used.

2.1.2 Average Density

The average density of the waste can be calculated and applied for each PCN, each PA code, or for the entire study. The previous generation study analysis performed by DUS consultants used a single average density for the entire study. As was alluded to in the DUS study, this methodology is subject to inaccuracies due to the non-homogeneity of the waste stream. Since the Authority bills by weight, not by volume, using such a broad average tends to overcharge generators of large volumes of very light material and undercharge generators of heavier material. If the Authority ran only a landfill, charging generators of high volume light material more could be justified as landfill cost is driven by volume, not weight. Due to the fact that the Authority's landfill cost is such a small component of its total cost and that very little raw waste is landfilled without being subject to incineration first, the cost of which is based on weight, the tonnage measure is more valid and differential densities are more critical.

On the other hand, due to the difficulty and the cost of obtaining density measures in the field, only one density measure was calculated for each PCN for which a density measure was obtained. Therefore, the sample size is insufficient to draw a valid conclusion about the average density for individual businesses. As a compromise, the results of this study are based on using the calculated weighted average density for each PA code. This average density is calculated by dividing the total net weight of waste for the PA code by the total net volume of waste for the PA code. The results of this calculation are presented in Section 2.2.4.

2.1.3 Estimated Annual Waste Volume

The total estimated annual volume for the population sample is calculated by multiplying the container size by the frequency of collection per week, month, or year, whichever the case may be, and again by the number of periods in a year. The individual PCN annual volume estimates are then aggregated at the PA code level. The only variation from the above is in the case of compactor units. The annual generation of businesses that use compactors is difficult to determine because most compactors are serviced on an on-call basis, the density is significantly higher than that for uncompacted waste, and the quantity of waste in the container is impossible to determine without weighing them. In order to accommodate the compactors, the Authority contacted the haulers to obtain information on the pounds of waste collected during the study period from compactor units. For those compactors for which information was available, the weight of the waste was divided by the average density for the PA code to determine the average volume. The volume was divided by the container size to determine the frequency of collection, and the data record was modified to reflect the calculated container volume and frequency. In most instances, a full year of data was not available, therefore the quantity was annualized using seasonality factors for garbage and trash derived from the Authority's weigh station scale data for the last three years. These seasonality factors are in the schedule entitled *Calculated Seasonality Ratios* on Page 20. For additional information concerning the treatment of compactor units, see Section 1.3.6.

2.1.4 Average Generation Rate

The average generation rates per square foot for each PA code can be calculated by taking an unweighted average of the average generation rates for each PCN or by using a weighted average for the PA code. In the original study, DUS Consultants demonstrated an inverse relationship between the heated square feet and the waste generation per square foot. Because larger businesses generate larger quantities of waste yet on a smaller per square foot average, using a straight average would tend to skew the average generation rate toward the high end, most adversely affecting the larger businesses. The weighted average more accurately predicts aggregate generation and therefore is the better measure.

2.2 Summary Statistics

This section presents the summary statistics used to calculate the average generation rates per square foot of commercial property and the total estimated generation of commercial solid waste which are presented in Section 3 of the report.

2.2.1 Sample Size

The total number of businesses ultimately remaining in the study amounted to 1,691, as can be seen in the schedule on Page 9 along with a comparison to the desired goal. The overall sample size amounted to 8.50%. Insufficient data was available for parking structures or aircraft hangars to evaluate their generation habits at this time, therefore, the generation rates reflected in the report are those determined in the previous study. Coincidentally, both of these categories consist primarily of government owned facilities, which, as all other governmental generators, are assessed based on their actual generation.

Due to the limitations highlighted in Section 1.2, and the relatively small size of some PA codes, the sample

size for some PA codes is smaller than would optimally be preferred. This problem is mitigated somewhat through the natural combination of several PA codes into one. For example, only one regional shopping center was sampled, however there are three other categories of shopping centers, neighborhood shopping centers, community shopping centers, and super-regional shopping centers. Although the property appraiser makes a distinction between the four shopping centers, this distinction is not based on solid waste generation characteristics. Due to similar solid waste generation characteristics, their combination is reasonable and consistent with the 1991 methodology. Nonetheless, the small samples in several PA codes are a potential source of error.

2.2.2 Heated Square Feet

The properties in the study include a total of 24,374,266 square feet which amounts to 14.62% of the 166,663,219 square feet of commercial property in Palm Beach County (Source: 1994/1995 Assessment Program). A breakdown of the square footage by PA code is presented on Pages 10 and 11 of the report.

2.2.3 Average Percent Full

A total of 15,371 observations were made on 1,501 containers, an average of 10.24 observations per container. The distribution of the observations is as follows:

May	1,423	Observations	79.72% Full
June	1,428	Observations	82.87% Full
July	1,422	Observations	85.81% Full
August	986	Observations	88.63% Full
September	1,484	Observations	79.61% Full
October	1,486	Observations	79.75% Full
November	1,332	Observations	71.71% Full
December	1,281	Observations	74.30% Full
January	1,164	Observations	78.49% Full
February	1,261	Observations	82.81% Full
March	1,009	Observations	83.50% Full
April	1,095	Observations	82.14% Full

Taking an average of the monthly averages to account for seasonality and negate the impact of varying numbers of observations on the result, the average quantity of waste in the containers just prior to collection is estimated at 80.78%. Had an average of all observations been used rather than the above, the result would not have been significantly different (80.57%), although it would be skewed by the varying number of monthly observations. The average percent full did vary for different PA codes, however, there is no reason to believe that it is the result of anything other than random error. For this reason, the average percent full for the entire sample is used in all calculations. Nonetheless, the PA code average values are provided on Pages 12 and 13.

2.2.4 Average Density

The average density of the tested waste is estimated at 159.02 pounds per cubic yard. This is based on a net volume of 3,059.31 cubic yards weighing 486,490 pounds. The calculated average density for each individual

PA code is presented on Pages 14 and 15 in the table called *Average Density by PA Code* and the calculation of the weighted average density for all commercial waste is depicted on Pages 16 and 17 in the tables entitled *Weighted Average Solid Waste Density*.

Applying the estimated volume per square foot from the study to the commercial square footage for each PA code used in the 1994/95 assessment program, the weighted average density has been calculated and is 157.94 pounds per cubic yard. Since the latter value is calculated using the actual proportional countywide square footage rather than the proportions from the study, it is a superior estimate.

The Authority uses the average density in its governmental billing and in its franchise collection agreements. In these applications, the average density is multiplied by the container size to calculate the estimated weight for billing purposes. Because containers are on average 80.78% full at the time of collection, this calculation would overstate the weight of the waste if the calculated average density from this study were used in the calculation. The average density determined from this study must first be adjusted to account for the empty container volume by multiplying the average density by the average percent full.

As described previously, the average percent full was determined by sampling the containers in the study just prior to collection on their collection day. Although efforts were made to minimize the time between measurement and collection, this procedure has the potential of erring on the low side due to the possibility of more waste being added during the short time period between measurement and collection, while quite obviously, no waste would be removed. In order to account for the operational realities, it is recommended that a time allowance factor be added to the average percent full for governmental billing and franchise collection agreement purposes. Although the exact amount is impossible to estimate, an increase of 4% to 85% is reasonable. Based on this value, the average commercial density for governmental billing and franchise collection purposes would be 134.25 pounds per cubic yard (round to 134), which, coincidentally, is the same result determined in the previous study.

Again, for the purpose of calculating the average generation rates for each PA code, the PA code average densities are used, as this most accurately depicts the relative generation rates by PA code as a weight measure.

2.2.5 Estimated Annual Volume

The annual volume by PA code for the sample is presented on Pages 18 and 19 of the study in the table called *Annual Volume by PA Code*. The total estimated annual volume of the PCN's in the study is 894,291 cubic yards prior to adjustments to account for vacancies, level of service changes, and empty container volume. After adjustment for vacancies and level of service changes, the annual volume for the PCN's in the study was 892,680 cubic yards.

[Continued on Page 21]

1993 Commercial Generation Study
Sample Size and Tested Units by PA Code

		Single-Card Parcels	Multi-Card Parcels	Total Buildings	Ten Percent Sample	Proposed Sample		Actual Sample	Sample Percent
17	Dormitory	49	620	669	67	49		25	3.74%
34	Strip Store	321	627	948	95	95		93	9.81%
35	Retail Shop	723	683	1,406	141	141		103	7.33%
36	Discount Store	73	110	183	18	18		15	8.20%
37	Department Store	20	25	45	5	5		20	44.44%
38	Neighborhood Shopping Center	5	197	202	20	20	*	12	5.94%
39	Community Shopping Center	2	168	170	17	17	*	3	1.76%
40	Shopping Center Regional	1	1	2	0	2	*	2	100.00%
41	Shopping Center Super Regional	2	5	7	1	5	*	2	28.57%
42	Supermarket	32	137	169	17	17		31	18.34%
43	Convenience Store	249	179	428	43	43		49	11.45%
44	Hotel	9	11	20	2	5		6	30.00%
45	Hotel/Motel/Resort	236	61	297	30	30		10	3.37%
46	Low Rise Motel	75	300	375	38	38		61	16.27%
47	High Rise Motel	2	35	37	4	5	*	4	10.81%
49	Office-Low Rise	1,195	1,348	2,543	254	254		209	8.22%
50	Office-High Rise	26	45	71	7	7		7	9.86%
51	Office Condo	154	4	158	16	16		0	0.00%
52	Medical Office	332	137	469	47	47		43	9.17%
53	Hospital	4	60	64	6	6	*	5	7.81%
5301	Hospitals with Incinerators							3	4.69%
54	Nursing Home	21	129	150	15	15		22	14.67%
55	Bar/Nightclub	87	168	255	26	26		18	7.06%
56	Restaurant	286	1,591	1,877	188	188		151	8.04%
57	Fast Food Restaurant	190	166	356	36	36		27	7.58%
58	Bowling Alley	6	9	15	2	5		5	33.33%
59	Arena	6	30	36	4	5		6	16.67%
60	Auditorium	3	24	27	3	5	*	2	7.41%
61	Theater	5	28	33	3	5		3	9.09%
62	Bank	66	31	97	10	10		10	10.31%
63	Branch Bank	159	74	233	23	23		17	7.30%
64	Service Station	226	45	271	27	27		15	5.54%
65	Garage	33	70	103	10	10		7	6.80%
66	Vehicle Sales/Repair	418	425	843	84	84		78	9.25%
67	Service Shop	119	144	263	26	26		31	11.79%
68	Mortuary	19	31	50	5	5		5	10.00%
69	Clubhouse	394	523	917	92	92		62	6.76%
70	Cold Storage/Packaging	10	33	43	4	5		5	11.63%
71	Transport Terminal	15	14	29	3	5		4	13.79%
72	Parking Structure	4	31	35	4	5	*	0	0.00%
73	Nursery/Daycare	116	56	172	17	17		21	12.21%
75	Auto Sales/Service	100	89	189	19	19		14	7.41%
77	Exceptional Office	1	0	1	0	1		0	0.00%
80	Light Manufacturing	269	212	481	48	48		40	8.32%
81	Heavy Manufacturing	1	23	24	2	5	*	1	4.17%
82	Distribution Warehouse	111	60	171	17	17		15	8.77%
83	Mini Warehouse	10	364	374	37	10		22	5.88%
84	Warehouse	1,537	1,584	3,121	312	312		288	9.23%
85	Aircraft Hangar	0	6	6	1	5	*	0	0.00%
86	Barns	23	169	192	19	19		4	2.08%
87	Pre-Fab Metal Building	6	13	19	2	5		2	10.53%
88	Technical Manufacturing	16	20	36	4	5		3	8.33%
90	School	17	12	29	3	5		4	13.79%
91	Churches	257	299	556	56	56		52	9.35%
92	Educational/Religious	85	531	616	62	62		54	8.77%
		8,126	11,757	19,883	1,992	1,983		1,691	8.50%

Criteria for Sample Size Determination

1. For ease of testing only single card percels will be tested.
2. A ten percent sample is desirable.
3. If a ten percent sample exceeds the number of single card parcels, all single card percels will be tested.
4. The minimum sample size for each PA code is 5 unless the number of units in the PA code is less than 5.
5. In cases of an insufficient sample size (*). multi-card parcels may have been included.
6. Hospital with incinerator category created subsequent to study due to differences in generation characteristics.

Heated Area by PA Code

PA Code	Number of PCNs	Heated Sq. Feet
1700	25	131,258
3400	93	849,936
3500	103	399,048
3600	15	629,500
3700	20	2,933,911
3800	12	383,026
3900	3	132,709
4000	2	257,549
4100	2	1,068,601
4200	31	492,623
4300	49	92,977
4400	6	64,803
4500	10	873,768
4600	61	578,360
4700	4	277,956
4900	209	2,839,501
5000	7	443,768
5200	43	321,814
5300	5	697,549
5301	3	1,131,326
5400	22	716,364
5500	18	54,930
5600	151	629,452
5700	27	74,134
5800	5	248,082
5900	6	407,944
6000	2	17,082
6100	3	55,329
6200	10	117,827
6300	17	78,485
6400	15	24,472
6500	7	22,886
6600	78	379,319
6700	31	112,231
6800	5	35,509
6900	62	369,091
7000	5	24,958

PA Code	Number of PCNs	Heated Sq. Feet
7100	4	13,339
7300	21	101,731
7500	14	133,144
8000	40	506,540
8100	1	13,715
8200	15	589,745
8300	21	863,087
8301	1	62,040
8400	288	2,945,424
8600	4	52,099
8700	2	6,942
8800	3	174,311
9000	4	17,180
9100	52	416,285
9200	54	510,606
	1,691	**24,374,266**

Average Percent Full by PA Code

PA	Observations	Sum of % Full	Average % Full
1700	127	10,304	81.13
3400	1,151	91,402	79.41
3500	1,121	93,283	83.21
3600	106	8,871	83.69
3700	20	1,532	76.60
3800	462	38,284	82.87
3900	94	7,746	82.40
4000	82	7,526	91.78
4200	243	21,604	88.91
4300	497	43,125	86.77
4400	52	4,536	87.23
4500	28	1,943	69.39
4600	305	23,141	75.87
4700	23	2,106	91.57
4900	2,012	153,745	76.41
5000	89	7,191	80.80
5100	47	3,792	80.68
5200	361	28,243	78.24
5300	32	2,892	90.38
5301	11	1,001	91.00
5400	73	5,801	79.47
5500	186	15,744	84.65
5600	1,557	130,103	83.56
5700	281	22,992	81.82
5800	14	992	70.86
5900	58	4,523	77.98
6000	6	527	87.83
6100	17	1,462	86.00

PA	Observations	Sum of % Full	Average % Full
6200	103	7,461	72.44
6300	163	11,993	73.58
6400	146	12,306	84.29
6500	58	4,276	73.72
6600	774	63,815	82.45
6700	280	23,707	84.67
6800	51	3,566	69.92
6900	442	32,888	74.41
7000	42	3,595	85.60
7100	21	1,826	86.95
7300	183	14,789	80.81
7500	93	7,564	81.33
8000	359	29,790	82.98
8200	128	10,368	81.00
8300	69	5,564	80.64
8301	9	691	76.78
8400	2,664	215,294	80.82
8600	14	955	68.21
8700	12	1,077	89.75
8800	47	3,340	71.06
9000	22	1,782	81.00
9100	262	18,197	69.45
9200	374	29,262	78.24
Grand Total :	**15,371**	**1,238,517**	**80.57**

Average Density by PA Code

PA Code	Net Volume	Net Weight	Average Density
1700	30.81	4,770	154.82
3400	210.02	29,288	139.45
3500	165.21	25,899	156.77
3600	32.78	3,820	116.53
3700	2.90	320	110.34
3800	85.78	14,630	170.55
3900	11.86	1,790	150.93
4000	11.10	2,540	228.83
4200	55.32	9,998	180.74
4300	119.65	14,705	122.90
4400	6.08	1,260	207.38
4500	17.96	1,717	95.61
4600	33.37	6,674	199.97
4700	3.40	460	135.29
4900	334.25	39,355	117.74
5000	16.44	2,010	122.26
5100	16.64	3,350	201.32
5200	68.89	7,918	114.94
5300	13.42	2,140	159.46
5301	13.12	2,260	172.26
5400	41.33	4,956	119.91
5500	34.59	5,330	154.09
5600	381.89	72,929	190.97
5700	93.65	19,010	202.99
5800	7.63	690	90.43
5900	21.19	4,910	231.71
6000	0.22	21	94.25
6100	2.00	490	245.00
6200	14.89	1,210	81.26
6300	20.91	3,051	145.92

PA Code	Net Volume	Net Weight	Average Density
6400	21.77	3,715	170.66
6500	7.53	1,327	176.16
6600	126.24	23,006	182.24
6700	39.34	6,230	158.38
6800	8.10	930	114.81
6900	67.76	9,822	144.96
7000	19.56	1,750	89.47
7100	3.22	240	74.53
7300	27.35	4,696	171.73
7500	20.75	2,506	120.76
8000	68.34	13,735	200.97
8100	0.24	40	166.67
8200	47.14	6,180	131.10
8300	28.04	5,079	181.11
8301	2.34	280	119.66
8400	568.79	101,405	178.28
8600	8.89	1,410	158.55
8700	0.40	60	150.00
8800	16.85	2,370	140.65
9000	6.23	1,139	182.90
9100	37.52	3,541	94.38
9200	65.60	9,528	145.23
Grand Total :	**3,059.31**	**486,490**	**159.02**

1993 Commercial Generation Study
Weighted Average Solid Waste Density

		Total Tested SF	Total Tested Volume	Average Volume per SF	Total Heated SF	Total Estimated Volume	Estimated Average Density	Weighted Average Density
1700	Dormitory	131,258	8,502	0.06	1,546,802	100,191	154.82	2.20
3400	Strip Store	849,936	30,175	0.04	8,561,805	303,967	139.45	6.02
3500	Retail Shop	399,048	23,554	0.06	4,656,096	274,831	156.77	6.11
3600	Discount Store	629,500	32,896	0.05	7,054,986	368,675	116.53	6.10
3700	Department Store	2,933,911	56,735	0.02	4,349,126	84,102	110.34	1.32
3800	Neighborhood Shopping Center	383,026	18,304	0.05	3,805,623	181,863	170.55	4.40
3900	Community Shopping Center	132,709	3,328	0.03	3,024,990	75,859	150.93	1.62
4000	Shopping Center Regional	257,549	8,632	0.03	260,413	8,728	228.83	0.28
4100	Shopping Center Super Regional	1,068,601	50,700	0.05	1,851,427	87,841	174.36	2.17
4200	Supermarket	492,623	55,156	0.11	4,134,531	462,921	180.74	11.87
4300	Convenience Store	92,977	19,980	0.21	739,287	158,867	122.90	2.77
4400	Hotel	64,803	3,163	0.05	499,730	24,393	207.38	0.72
4500	Hotel/Motel/Resort	873,768	28,931	0.03	1,109,648	36,741	95.61	0.50
4600	Low Rise Motel	578,360	18,056	0.03	4,076,367	127,261	199.97	3.61
4700	High Rise Motel	277,956	8,320	0.03	3,096,800	92,696	135.29	1.78
4900	Office-Low Rise	2,839,501	82,251	0.03	24,334,952	704,907	117.74	11.78
5000	Office-High Rise	443,768	7,072	0.02	6,186,121	98,584	122.26	1.71
5100	Office Condo	0	0	0.03	3,960,661	104,267	118.30	1.75
5200	Medical Office	321,814	10,284	0.03	3,000,050	95,873	114.94	1.56
5300	Hospital	697,549	19,600	0.03	2,084,563	58,573	159.46	1.33
5301	Hospitals with Incinerators	1,131,326	10,697	0.01	1,150,848	10,882	172.26	0.27
5400	Nursing Home	716,364	16,076	0.02	3,577,707	80,287	119.91	1.37
5500	Bar/Nightclub	54,930	5,460	0.10	729,894	72,551	154.09	1.59
5600	Restaurant	629,452	104,357	0.17	6,452,720	1,069,795	190.97	28.99
5700	Fast Food Restaurant	74,134	18,096	0.24	758,363	185,115	202.99	5.33
5800	Bowling Alley	248,082	6,864	0.03	517,402	14,316	90.43	0.18
5900	Arena	407,944	4,524	0.01	629,811	6,984	231.71	0.23
6000	Auditorium	17,082	439	0.03	648,148	16,664	94.25	0.22
6100	Theater	55,329	2,366	0.04	745,758	31,890	245.00	1.11
6200	Bank	117,827	2,392	0.02	989,031	20,078	81.26	0.23
6300	Branch Bank	78,485	4,138	0.05	797,407	42,046	145.92	0.87
6400	Service Station	24,472	2,878	0.12	352,529	41,452	170.66	1.00
6500	Garage	22,886	1,063	0.05	247,977	11,520	176.16	0.29
6600	Vehicle Sales/Repair	379,319	16,832	0.04	3,660,377	162,428	182.24	4.20
6700	Service Shop	112,231	5,914	0.05	1,008,578	53,146	158.38	1.19
6800	Mortuary	35,509	728	0.02	232,410	4,765	114.81	0.08
6900	Clubhouse	369,091	15,337	0.04	4,567,293	189,788	144.96	3.90
7000	Cold Storage/Packaging	24,958	4,608	0.18	279,384	51,583	89.47	0.65
7100	Transport Terminal	13,339	464	0.03	20,866	726	74.53	0.01
7200	Parking Structure						0.00	0.00
7400	Gas Mart	0	0	0.12	36,987	4,349	170.66	0.11
7300	Nursery/Daycare	101,731	4,128	0.04	865,215	35,105	171.73	0.86
7500	Auto Sales/Service	133,144	5,257	0.04	1,428,107	56,384	120.76	0.97
7700	Exceptional Office						0.00	0.00
8000	Light Manufacturing	506,540	14,292	0.03	5,545,571	156,472	200.97	4.46
8100	Heavy Manufacturing	13,715	936	0.07	234,580	16,009	166.67	0.38
8200	Distribution Warehouse	589,745	12,544	0.02	4,030,792	85,736	131.10	1.60
8300	Mini Warehouse	925,127	11,867	0.01	3,647,311	46,785	176.40	1.17
8400	Warehouse	2,945,424	106,278	0.04	24,439,218	881,823	178.28	22.31
8500	Aircraft Hangar						0.00	0.00
8600	Barns	52,099	2,104	0.04	304,336	12,291	158.55	0.28
8700	Pre-Fab Metal Building	6,942	328	0.05	35,368	1,671	150.00	0.04
8800	Technical Manufacturing	174,311	3,412	0.02	2,463,657	48,224	140.65	0.96
9000	School	17,180	893	0.05	122,542	6,368	182.90	0.17
9100	Churches	416,285	5,638	0.01	3,533,614	47,862	94.38	0.64
9200	Educational/Religious	510,606	16,130	0.03	4,132,947	130,556	145.23	2.69
	Total	24,374,266	892,680		166,520,726	7,046,792		157.94

Weighted Average Solid Waste Density
Combined Commercial Categories

		1994 Estimated Volume	Measured Net Volume	Measured Net Weight	Calculated Average Density	Weighted Average Density
	Shopping Centers					
3800	Neighborhood Shopping Center	181,863	85.78	14,630	170.55	116.41
3900	Community Shopping Center	75,859	11.86	1,790	150.93	42.97
4000	Shopping Center Regional	8,728	11.10	2,540	228.83	7.50
4100	Shopping Center Super Regional	87,841				
		354,291	108.74	18,960	174.36	166.87
	Hotel/Motel/Resorts					
4400	Hotel	24,393	6.08	1,260	207.24	17.98
4500	Hotel/Motel/Resort	36,741	17.96	1,717	95.60	12.50
4600	Low Rise Motel	127,261	33.37	6,674	200.00	90.55
4700	High Rise Motel	92,696	3.4	460	135.29	44.62
		281,092	60.81	9,651	158.71	165.64
	Offices					
4900	Office-Low Rise	704,907	334.25	39,355	117.74	103.30
5000	Office-High Rise	98,584	16.44	2,010	122.26	15.00
5100	Office-Condo (2)	104,267				
		907,758	350.69	41,365	117.95	118.30

Notes:
(1) When PA codes are grouped together, a weighted average density is used based on the estimated 1994 solid waste volumes.
(2) Due to the possible inclusion of waste not associated with offices in the office condo results, these results are not used.

Annual Volume by PA Code

PA Code	Annual Volume
1700	8,502.00
3400	30,226.99
3500	23,554.19
3600	32,896.00
3700	56,735.20
3800	18,304.00
3900	3,328.00
4000	8,632.00
4100	50,700.00
4200	55,675.92
4300	20,032.00
4400	3,163.25
4500	28,931.28
4600	18,055.94
4700	8,320.00
4900	82,303.34
5000	7,072.00
5200	10,284.20
5300	19,600.00
5301	10,697.44
5400	16,075.89
5500	5,460.00
5600	105,257.38
5700	18,096.00
5800	6,864.00
5900	4,524.00
6000	439.17
6100	2,366.00
6200	2,392.00
6300	4,138.39
6400	2,877.52
6500	1,063.17
6600	16,866.82
6700	5,913.91
6800	728.00
6900	15,337.10

PA Code	Annual Volume
7000	4,608.00
7100	464.00
7300	4,127.61
7500	5,256.73
8000	14,292.37
8100	936.00
8200	12,544.00
8300	11,242.82
8301	624.00
8400	106,277.70
8600	2,104.09
8700	328.00
8800	3,412.00
9000	892.78
9100	5,638.45
9200	16,129.63
	894,291.29

Solid Waste Authority of Palm Beach County
Calculated Seasonality Ratios

	Garbage and Trash Tonnage				
	FY 90/91	FY 91/92	FY 92/93	Total	%
October	77,012.24	77,591.80	65,627.30	220,231.34	8.46%
November	71,177.76	71,530.43	66,676.54	209,384.73	8.04%
December	71,265.53	75,923.85	70,645.59	217,834.97	8.37%
January	80,654.01	77,913.82	72,011.21	230,579.04	8.86%
February	70,897.39	72,313.24	66,113.07	209,323.70	8.04%
March	75,933.62	78,356.96	82,381.86	236,672.44	9.09%
April	77,898.71	75,551.10	76,462.81	229,912.62	8.83%
May	74,352.02	68,228.74	67,525.93	210,106.69	8.07%
June	65,899.08	75,103.24	73,114.91	214,117.23	8.22%
July	73,731.53	72,422.63	67,815.32	213,969.48	8.22%
August	68,245.01	68,309.95	70,544.06	207,099.02	7.95%
September	65,001.63	70,377.79	69,196.05	204,575.47	7.86%
	872,068.53	883,623.55	848,114.65	2,603,806.73	

Monthly Ratios

October	1.01
November	0.96
December	1.00
January	1.06
February	0.96
March	1.09
April	1.06
May	0.97
June	0.99
July	0.99
August	0.95
September	0.94
Sum	12.00

Source: Solid Waste Authority Waste Statistics; FYEOCM.XLS.

3.0 Generation Study Results and Discussion

The summary results presented in Subsection 2.2 are compiled, summarized, and analyzed in this section of the report. The average waste generation rates for each PA code are presented. The codes are then grouped into business categories with similar businesses. Finally, the business categories are separated into low, medium-low, medium, medium-high and high generator categories, and the weighted average generation rates for each of these categories are determined in the same manner they would be in the Annual Commercial Assessment Program.

3.1 Mean Generation per SF by PA Code

The minimum, maximum, mean and standard deviation of the calculated annual commercial waste generation rates (cy/sf) are presented on Pages 22 and 23 in the table entitled *Mean Generation per SF by PA Code*. The mean was calculated by dividing the estimated annual generation for each parcel in every PA code by the heated square feet of the business to determine the parcel generation rate and averaging the resulting generation rates across the PA code. The standard deviation is a measure of the variability of the data about the mean.

Generally speaking, as in the previous study, the standard deviations of the waste generation rates in the study indicate a large variation in waste generation characteristics within PA codes. In many cases, the variation about the mean is greater than the mean itself, which depicts a very large variation. This results from substantial differences in the generation characteristics of similar businesses and highlights the difficulty of using the Property Appraiser's designations alone as a basis for commercial billing for solid waste disposal. The results seem to validate DUS Consultants' conclusion that a 100% Assessment based on the Property Appraiser's designations would not result in rate equity or fairness and indicate that the Authority should continue to use a billing methodology incorporating a volume component.

3.2 Category Average Generation Rate

For the purpose of waste generation rate calculation, the category average waste generation is used. This is calculated by dividing the total estimated weight of the tested waste for each PA code by the total tested heated square feet of property in the PA code. First, the total annual volume of waste (pp. 18-19) and total tested square feet of property (pp. 10-11) are compiled by PA code. Second, the total tested volume is multiplied by the study average percent full of 80.78% to calculate the adjusted average annual volume. Third this value is divided by the heated square feet to determine the adjusted average volume per sf (p. 25). Finally, the annual volume generation rate is multiplied by the PA code average density to produce the estimated average generation rate in pounds per square foot (p. 26).

The category average generation rate was selected over the mean generation rate in Section 3.1 for several reasons. In the majority of cases, the mean generation rate produces a higher generation rate than the latter measure, a finding which is consistent with the results in the previous study. Additionally, when the mean generation rate is aggregated to the total commercial square footage, the resultant total estimated commercial generation is outside the reasonable range. This is primarily the result of the fact that although there is a direct relationship between solid waste generation and square footage, it is not linear but decreases as square footage increases. In other words, although the quantity of waste increases with size, the average generation rate is often lower for larger PCN's than for smaller ones.

Mean Generation per SF by PA

PA	# of PCNs	Minimum	Maximum	Mean	Standard Dev.
1700	25	0.000	0.270	0.076	0.053
3400	93	0.000	0.306	0.042	0.036
3500	103	0.000	0.520	0.082	0.083
3600	15	0.014	0.155	0.043	0.034
3700	20	0.000	0.057	0.019	0.013
3800	12	0.007	0.185	0.052	0.049
3900	3	0.015	0.077	0.039	0.033
4000	2	0.032	0.035	0.033	0.002
4100	2	0.036	0.056	0.046	0.014
4200	31	0.012	5.673	0.303	0.999
4300	49	0.069	0.709	0.231	0.134
4400	6	0.002	0.285	0.070	0.107
4500	10	0.016	1.387	0.181	0.425
4600	61	0.000	0.257	0.041	0.036
4700	4	0.007	0.041	0.023	0.014
4900	209	0.004	0.802	0.053	0.083
5000	7	0.010	0.048	0.018	0.014
5200	43	0.006	0.338	0.047	0.056
5300	5	0.015	0.054	0.031	0.015
5301	3	0.006	0.019	0.010	0.008
5400	22	0.000	0.067	0.028	0.018
5500	18	0.036	0.347	0.125	0.086
5600	151	0.029	1.020	0.190	0.139
5700	27	0.033	0.866	0.264	0.185
5800	5	0.021	0.040	0.027	0.008
5900	6	0.005	0.025	0.014	0.008
6000	2	0.003	0.052	0.027	0.035
6100	3	0.013	0.080	0.055	0.037
6200	10	0.008	0.040	0.023	0.013
6300	17	0.007	1.017	0.129	0.243
6400	15	0.039	0.348	0.133	0.086
6500	7	0.000	0.104	0.046	0.040
6600	78	0.000	0.253	0.056	0.042
6700	31	0.000	0.499	0.074	0.095
6800	5	0.011	0.034	0.021	0.010
6900	62	0.003	0.310	0.048	0.054
7000	5	0.054	0.613	0.197	0.235

PA	# of PCNs	Minimum	Maximum	Mean	Standard Dev.
7100	4	0.007	0.297	0.105	0.134
7300	21	0.007	0.097	0.040	0.025
7500	14	0.000	0.635	0.080	0.161
8000	40	0.000	0.101	0.034	0.025
8100	1	0.068	0.068	0.068	
8200	15	0.000	0.082	0.019	0.021
8300	21	0.001	0.198	0.031	0.051
8301	1	0.010	0.010	0.010	
8400	288	0.000	2.036	0.061	0.162
8600	4	0.012	0.361	0.100	0.174
8700	2	0.000	0.094	0.047	0.066
8800	3	0.009	0.043	0.022	0.018
9000	4	0.017	0.139	0.057	0.056
9100	52	0.000	0.057	0.015	0.014
9200	54	0.000	0.320	0.049	0.074
	1,691				

Applying equal weights to both small and large businesses, as the mean generation rate calculation does, results in an overestimation of the generation for larger businesses. Additionally, the small sample sizes in many PA codes make using a mean generation rate even more unreliable because it increases the potential of a small PCN with a high generation rate skewing the results.

It must be noted, as previously stated, that because no parking structures or aircraft hangars were tested and no data was available, the generation rates presented are those from the previous study. Additionally, no museums were studied as these were subjected to a special study in 1993/1994 in which it was determined that they should be separated from the educational/religious classification and placed in the low generator category.

3.3 Category Summary and Total Commercial Waste Quantity Estimate

Because the PA codes or business use categories maintained by the Property Appraiser's office are not based on waste generation characteristics, some of the distinctions made in the Property Appraiser's classifications are unnecessary, and therefore have been eliminated. For example, a distinction is made between high rise and low rise office buildings in the Property Appraisers system. For the purpose of the generation study, these two categories have been combined, as there is no reason to believe that an office in a high rise would generate waste any differently if it were relocated to a low rise office building.

The generation study *Category Summary* on Page 27 provides the average generation rate for each business classification, including the combined shopping center category, hotel/motel/resort category, office category, and automobile service category. When the categories are combined, the category ratio in pounds per square foot is based on a weighted average of the PA code generation rates, using the square footage from the *1994/1995 Commercial Assessment Program.* Applying the calculated average generation rates to the total commercial square footage, the total estimated annual commercial generation is 448,557 tons, which amounts to 5.38 pounds per square foot. In the previous study, the total calculated annual generation amounted to 549,296 tons or 6.60 pounds per square foot (DUS Consultants, Table 2-1).

3.4 Category Ranking

Using the average generation rates calculated above, the commercial classifications have been ranked in increasing order of waste generation rate. This ranking is presented on Page 28 in the table titled *Category Ranking.*

3.5 Defining Class Boundaries

The ranked data is then grouped into broader categories for assessment billing purposes. The current assessment program consists of three categories: low, medium, and high generators. Broad categories are used for two reasons. First, the assessment is only intended to represent a base capacity charge to cover fixed system costs, while the variable costs of the system are covered by tipping fees, which charge every individual business based upon the quantity of waste it actually generates. Second, the variability of waste generation rates within business classifications precludes the use of individual business classifications for assessment billing purposes. Although to do so would appear to provide increased accuracy, in reality, it would not.

1993 Commercial Generation Study
Average Volume per Square Foot

PA	PA Description	Total Tested SF	Total Annual Volume	Average Percent Full PA	Average Percent Full Study	Total Adjusted Volume PA %	Total Adjusted Volume Study %	Average Volume per SF PA%	Average Volume per SF Study %
1700	Dormitory	131,258	8,502.00	81.13%	80.78%	6,897.67	6,867.92	0.05	**0.05**
3400	Strip Store	849,936	30,175.03	79.41%	80.78%	23,961.99	24,375.39	0.03	**0.03**
3500	Retail Shop	399,048	23,554.19	83.20%	80.78%	19,597.09	19,027.07	0.05	**0.05**
3600	Discount Store	629,500	32,896.00	83.69%	80.78%	27,530.66	26,573.39	0.04	**0.04**
3700	Department Store	2,933,911	56,735.20	76.60%	80.78%	43,459.16	45,830.69	0.01	**0.02**
3800	Neighborhood Shopping Center	383,026	18,304.00	82.87%	80.78%	15,168.52	14,785.97	0.04	**0.04**
3900	Community Shopping Center	132,709	3,328.00	82.40%	80.78%	2,742.27	2,688.36	0.02	**0.02**
4000	Shopping Center Regional	257,549	8,632.00	91.78%	80.78%	7,922.45	6,972.93	0.03	**0.03**
4100	Shopping Center Super Regiona	1,068,601	50,700.00	80.57%	80.78%	40,848.99	40,955.46	0.04	**0.04**
4200	Supermarket	492,623	55,156.32	89.80%	80.78%	49,530.38	44,555.28	0.10	**0.09**
4300	Convenience Store	92,977	19,980.04	87.84%	80.78%	17,550.47	16,139.88	0.19	**0.17**
4400	Hotel	64,803	3,163.25	87.23%	80.78%	2,759.30	2,555.27	0.04	**0.04**
4500	Hotel/Motel/Resort	873,768	28,931.28	69.39%	80.78%	20,075.42	23,370.69	0.02	**0.03**
4600	Low Rise Motel	578,360	18,055.94	75.87%	80.78%	13,699.04	14,585.59	0.02	**0.03**
4700	High Rise Motel	277,956	8,320.00	91.57%	80.78%	7,618.62	6,720.90	0.03	**0.02**
4900	Office-Low Rise	2,839,501	82,251.38	76.35%	80.78%	62,798.93	66,442.66	0.02	**0.02**
5000	Office-High Rise	443,768	7,072.00	80.80%	80.78%	5,714.18	5,712.76	0.01	**0.01**
5100	Office Condo	0	0.00	80.68%	80.78%	0.00	0.00		
5200	Medical Office	321,814	10,284.20	78.24%	80.78%	8,046.36	8,307.58	0.03	**0.03**
5300	Hospital	697,549	19,600.00	90.38%	80.78%	17,714.48	15,832.88	0.03	**0.02**
5301	Hospitals with Incinerators	1,131,326	10,697.44	91.00%	80.78%	9,734.67	8,641.39	0.01	**0.01**
5400	Nursing Home	716,364	16,075.89	79.47%	80.78%	12,775.51	12,986.10	0.02	**0.02**
5500	Bar/Nightclub	54,930	5,460.00	84.65%	80.78%	4,621.89	4,410.59	0.08	**0.08**
5600	Restaurant	629,452	104,356.71	83.56%	80.78%	87,200.47	84,299.35	0.14	**0.13**
5700	Fast Food Restaurant	74,134	18,096.00	81.82%	80.78%	14,806.15	14,617.95	0.20	**0.20**
5800	Bowling Alley	248,082	6,864.00	70.86%	80.78%	4,863.83	5,544.74	0.02	**0.02**
5900	Arena	407,944	4,524.00	77.98%	80.78%	3,527.82	3,654.49	0.01	**0.01**
6000	Auditorium	17,082	439.17	87.83%	80.78%	385.72	354.76	0.02	**0.02**
6100	Theater	55,329	2,366.00	86.00%	80.78%	2,034.76	1,911.25	0.04	**0.03**
6200	Bank	117,827	2,392.00	72.44%	80.78%	1,732.76	1,932.26	0.01	**0.02**
6300	Branch Bank	78,485	4,138.39	73.58%	80.78%	3,045.03	3,342.99	0.04	**0.04**
6400	Service Station	24,472	2,877.52	83.49%	80.78%	2,402.44	2,324.46	0.10	**0.09**
6500	Garage	22,886	1,063.17	73.72%	80.78%	783.77	858.83	0.03	**0.04**
6600	Vehicle Sales/Repair	379,319	16,832.18	82.45%	80.78%	13,878.13	13,597.04	0.04	**0.04**
6700	Service Shop	112,231	5,913.91	84.67%	80.78%	5,007.31	4,777.26	0.04	**0.04**
6800	Mortuary	35,509	728.00	69.92%	80.78%	509.02	588.08	0.01	**0.02**
6900	Clubhouse	369,091	15,337.10	74.41%	80.78%	11,412.34	12,389.31	0.03	**0.03**
7000	Cold Storage/Packaging	24,958	4,608.00	85.60%	80.78%	3,944.45	3,722.34	0.16	**0.15**
7100	Transport Terminal	13,339	464.00	86.95%	80.78%	403.45	374.82	0.03	**0.03**
7200	Parking Structure	0	0.00		80.78%	0.00	0.00		
7300	Nursery/Daycare	101,731	4,127.61	80.81%	80.78%	3,335.52	3,334.28	0.03	**0.03**
7500	Auto Sales/Service	133,144	5,256.73	81.33%	80.78%	4,275.30	4,246.39	0.03	**0.03**
7700	Exceptional Office	0	0.00		80.78%	0.00	0.00		
8000	Light Manufacturing	506,540	14,292.37	82.98%	80.78%	11,859.81	11,545.38	0.02	**0.02**
8100	Heavy Manufacturing	13,715	936.00		80.78%	0.00	756.10	0.00	**0.06**
8200	Distribution Warehouse	589,745	12,544.00	81.00%	80.78%	10,160.64	10,133.04	0.02	**0.02**
8300	Mini Warehouse	925,127	11,866.82	80.20%	80.78%	9,517.19	9,586.02	0.01	**0.01**
8400	Warehouse	2,945,424	106,277.70	80.84%	80.78%	85,914.89	85,851.13	0.03	**0.03**
8500	Aircraft Hangar	0	0.00		80.78%	0.00	0.00		
8600	Barns	52,099	2,104.09	68.21%	80.78%	1,435.20	1,699.68	0.03	**0.03**
8700	Pre-Fab Metal Building	6,942	328.00	89.75%	80.78%	294.38	264.96	0.04	**0.04**
8800	Technical Manufacturing	174,311	3,412.00	71.06%	80.78%	2,424.57	2,756.21	0.01	**0.02**
9000	School	17,180	892.78	81.00%	80.78%	723.15	721.19	0.04	**0.04**
9100	Churches	416,285	5,638.45	69.45%	80.78%	3,915.90	4,554.74	0.01	**0.01**
9200	Educational/Religious	510,606	16,129.63	78.24%	80.78%	12,619.82	13,029.52	0.02	**0.03**
	Total Study	24,374,266	892,680.49			586,566.76	583,646.87	0.02	**0.02**

Notes:

(1) Total annual volume adjusted to account for level of service changes.

(2) Subsequent results based on PA code percent full measure.

1993 Commercial Generation Study
Average Pounds per Square Foot

PA	PA Description	Total Volume per SF Study%	Average Density PA Code	Average Density Total Study	Average Generation per SF PA Density	Average Generation per SF Study Density
1700	Dormitory	0.05	154.82	157.94	**8.10**	8.26
3400	Strip Store	0.03	139.45	157.94	**4.00**	4.53
3500	Retail Shop	0.05	156.77	157.94	**7.47**	7.53
3600	Discount Store	0.04	116.53	157.94	**4.92**	6.67
3700	Department Store	0.02	110.34	157.94	**1.72**	2.47
3800	Neighborhood Shopping Center	0.04	170.55	157.94	**6.58**	6.10
3900	Community Shopping Center	0.02	150.93	157.94	**3.06**	3.20
4000	Shopping Center Regional	0.03	228.83	157.94	**6.20**	4.28
4100	Shopping Center Super Regiona	0.04	174.36	157.94	**6.68**	6.05
4200	Supermarket	0.09	180.74	157.94	**16.35**	14.29
4300	Convenience Store	0.17	122.90	157.94	**21.33**	27.42
4400	Hotel	0.04	207.38	157.94	**8.18**	6.23
4500	Hotel/Motel/Resort	0.03	95.61	157.94	**2.56**	4.22
4600	Low Rise Motel	0.03	199.97	157.94	**5.04**	3.98
4700	High Rise Motel	0.02	135.29	157.94	**3.27**	3.82
4900	Office-Low Rise	0.02	117.74	157.94	**2.76**	3.70
5000	Office-High Rise	0.01	122.26	157.94	**1.57**	2.03
5100	Office Condo		118.30	157.94		
5200	Medical Office	0.03	114.94	157.94	**2.97**	4.08
5300	Hospital	0.02	159.46	157.94	**3.62**	3.58
5301	Hospitals with Incinerators	0.01	172.26	157.94	**1.32**	1.21
5400	Nursing Home	0.02	119.91	157.94	**2.17**	2.86
5500	Bar/Nightclub	0.08	154.09	157.94	**12.37**	12.68
5600	Restaurant	0.13	190.97	157.94	**25.58**	21.15
5700	Fast Food Restaurant	0.20	202.99	157.94	**40.03**	31.14
5800	Bowling Alley	0.02	90.43	157.94	**2.02**	3.53
5900	Arena	0.01	231.71	157.94	**2.08**	1.41
6000	Auditorium	0.02	94.25	157.94	**1.96**	3.28
6100	Theater	0.03	245.00	157.94	**8.46**	5.46
6200	Bank	0.02	81.26	157.94	**1.33**	2.59
6300	Branch Bank	0.04	145.92	157.94	**6.22**	6.73
6400	Service Station	0.09	170.66	157.94	**16.21**	15.00
6500	Garage	0.04	176.16	157.94	**6.61**	5.93
6600	Vehicle Sales/Repair	0.04	182.24	157.94	**6.53**	5.66
6700	Service Shop	0.04	158.38	157.94	**6.74**	6.72
6800	Mortuary	0.02	114.81	157.94	**1.90**	2.62
6900	Clubhouse	0.03	144.96	157.94	**4.87**	5.30
7000	Cold Storage/Packaging	0.15	89.47	157.94	**13.34**	23.56
7100	Transport Terminal	0.03	74.53	157.94	**2.09**	4.44
7200	Parking Structure			157.94		
7300	Nursery/Daycare	0.03	171.73	157.94	**5.63**	5.18
7500	Auto Sales/Service	0.03	120.76	157.94	**3.85**	5.04
7700	Exceptional Office			157.94		
8000	Light Manufacturing	0.02	200.97	157.94	**4.58**	3.60
8100	Heavy Manufacturing	0.06	166.67	157.94	**9.19**	8.71
8200	Distribution Warehouse	0.02	131.10	157.94	**2.25**	2.71
8300	Mini Warehouse	0.01	176.40	157.94	**1.83**	1.64
8400	Warehouse	0.03	178.28	157.94	**5.20**	4.60
8500	Aircraft Hangar			157.94		
8600	Barns	0.03	158.55	157.94	**5.17**	5.15
8700	Pre-Fab Metal Building	0.04	150.00	157.94	**5.73**	6.03
8800	Technical Manufacturing	0.02	140.65	157.94	**2.22**	2.50
9000	School	0.04	182.90	157.94	**7.68**	6.63
9100	Churches	0.01	94.38	157.94	**1.03**	1.73
9200	Educational/Religious	0.03	145.23	157.94	**3.71**	4.03

Notes:

(1) Study density equals weighted average density from schedule entitled Weighted Average Solid Waste Density.

(2) Average generation per square foot using PA code average density used in subsequent calculations.

1993 Commercial Generation Study
Category Summary

PA Code		1,994 Square Footage	Tested Square Footage	Tested Measured Waste	Category Ratio (Lbs/SF)	Estimated Total Waste Generation (Tons per Year)
1700	**Dormitory**	**1,546,802**	**131,258**	**1,063,290.69**	**8.10**	**6,265**
3400	**Strip Store**	**8,561,805**	**849,936**	**3,399,148.03**	**4.00**	**17,121**
3500	**Retail Shop**	**4,656,096**	**399,048**	**2,982,874.50**	**7.47**	**17,402**
3600	**Discount Store**	**7,054,986**	**629,500**	**3,096,597.00**	**4.92**	**17,352**
3700	**Department Store**	**4,349,126**	**2,933,911**	**5,056,958.84**	**1.72**	**3,748**
3800	Neighborhood Shopping Cer	3,805,623	383,026	2,467,396.98	6.44	12,258
3900	Community Shopping Cente	3,024,990	132,709	448,617.63	3.38	5,113
4000	Shopping Center Regional	260,413	257,549	1,163,601.99	4.52	588
4100	Shopping Center Super Reg	1,851,427	1,068,601	6,834,409.25	6.40	5,921
	Shopping Centers	**8,942,453**	**1,841,885**	**10,914,025.85**	**5.34**	**23,879**
4200	**Supermarket**	**4,134,531**	**492,623**	**8,052,920.46**	**16.35**	**33,794**
4300	**Convenience Store**	**739,287**	**92,977**	**1,983,590.80**	**21.33**	**7,886**
4400	Hotel	499,730	64,803	423,265.61	6.53	1,632
4500	Hotel/Motel/Resort	1,109,648	873,768	3,871,213.45	4.43	2,458
4600	Low Rise Motel	4,076,367	578,360	2,416,014.70	4.18	8,514
4700	High Rise Motel	3,096,800	277,956	1,113,275.87	4.01	6,202
	Hotel/Motel/Resort	**8,782,545**	**1,794,887**	**7,823,769.62**	**4.28**	**18,806**
4900	Office-Low Rise	24,334,952	2,839,501	7,859,900.21	2.77	33,680
5000	Office-High Rise	6,186,121	443,768	675,796.74	1.52	4,710
5100	Office Condo	3,960,661	0	0.00	2.52	4,982
	Office	**34,481,734**	**3,283,269**	**8,535,696.95**	**2.52**	**43,372**
5200	**Medical Office**	**3,000,050**	**321,814**	**954,872.87**	**2.97**	**4,451**
5300	**Hospital**	**2,084,563**	**697,549**	**2,524,711.04**	**3.62**	**3,772**
5301	**Hospitals with Incinerators**	**1,150,848**	**1,131,326**	**1,488,566.19**	**1.32**	**757**
5400	**Nursing Home**	**3,577,707**	**716,364**	**1,557,163.72**	**2.17**	**3,888**
5500	**Bar/Nightclub**	**729,894**	**54,930**	**679,627.50**	**12.37**	**4,515**
5600	**Restaurant**	**6,452,720**	**629,452**	**16,098,646.93**	**25.58**	**82,516**
5700	**Fast Food Restaurant**	**758,363**	**74,134**	**2,967,297.43**	**40.03**	**15,177**
5800	**Bowling Alley**	**517,402**	**248,082**	**501,410.77**	**2.02**	**523**
5900	**Arena**	**629,811**	**407,944**	**846,781.23**	**2.08**	**654**
6000	**Auditorium**	**648,148**	**17,082**	**33,436.27**	**1.96**	**634**
6100	**Theater**	**745,758**	**55,329**	**468,257.43**	**8.46**	**3,156**
6200	**Bank**	**989,031**	**117,827**	**157,015.25**	**1.33**	**659**
6300	**Branch Bank**	**797,407**	**78,485**	**487,809.31**	**6.22**	**2,478**
6400	Service Station	352,529	24,472	396,692.46	16.21	2,857
7400	Gas Mart	36,987	0	0.00	16.21	300
	Automobile Service	**389,516**	**24,472**	**396,692.46**	**16.21**	**3,157**
6500	**Garage**	**247,977**	**22,886**	**151,291.27**	**6.61**	**820**
6600	**Vehicle Sales/Repair**	**3,660,377**	**379,319**	**2,477,923.66**	**6.53**	**11,956**
6700	**Service Shop**	**1,008,578**	**112,231**	**756,621.88**	**6.74**	**3,400**
6800	**Mortuary**	**232,410**	**35,509**	**67,517.28**	**1.90**	**221**
6900	**Clubhouse**	**4,567,293**	**369,091**	**1,795,954.29**	**4.87**	**11,112**
7000	**Cold Storage/Packaging**	**279,384**	**24,958**	**333,037.97**	**13.34**	**1,864**
7100	**Transport Terminal**	**20,866**	**13,339**	**27,935.27**	**2.09**	**22**
7200	**Parking Structure**	**21,000**	**0**	**0.00**	**0.30**	**3**
7300	**Nursery/Daycare**	**865,215**	**101,731**	**572,596.48**	**5.63**	**2,435**
7500	**Auto Sales/Service**	**1,428,107**	**133,144**	**512,793.63**	**3.85**	**2,750**
7700	**Exceptional Office**	**0**	**0**	**0.00**	**na**	**0**
8000	**Light Manufacturing**	**5,545,571**	**506,540**	**2,320,274.31**	**4.58**	**12,701**
8100	**Heavy Manufacturing**	**234,580**	**13,715**	**126,019.32**	**1.50**	**176**
8200	**Distribution Warehouse**	**4,030,792**	**589,745**	**1,328,441.96**	**2.25**	**4,540**
8300	**Mini Warehouse**	**3,647,311**	**925,127**	**1,690,963.34**	**1.83**	**3,333**
8400	**Warehouse**	**24,439,218**	**2,945,424**	**15,305,538.75**	**5.20**	**63,498**
8500	**Aircraft Hangar**	**121,493**	**0**	**0.00**	**6.10**	**371**
8600	**Barns**	**304,336**	**52,099**	**269,484.88**	**5.17**	**787**
8700	**Pre-Fab Metal Building**	**35,368**	**6,942**	**39,743.76**	**5.73**	**101**
8800	**Technical Manufacturing**	**2,463,657**	**174,311**	**387,661.44**	**2.22**	**2,740**
9000	**School**	**122,542**	**17,180**	**131,905.23**	**7.68**	**470**
9100	**Churches**	**3,533,614**	**416,285**	**429,876.35**	**1.03**	**1,824**
9200	**Educational/Religious**	**3,987,059**	**510,606**	**1,892,276.48**	**3.71**	**7,388**
9201	**Museums**	**145,888**	**0**	**0.00**	**1.12**	**82**
	Total	**166,663,219**	**24,374,266**	**112,689,019**	**5.38**	**448,557**

1993 Commercial Generation Study
Category Ranking

PA Code		SF	Rate	Annual Tons		Totals
7200	Parking Structure	21,000	0.30	3.15		
9100	Churches	3,533,614	1.03	1,824.49		
9201	Museums	145,888	1.12	83.16		
5301	Hospitals with Incinerators	1,150,848	1.32	757.13		
6200	Bank	989,031	1.33	658.99	T	11,439.58
8100	Heavy Manufacturing	234,580	1.50	175.94	%	2.55%
3700	Department Store	4,349,126	1.72	3,748.13	R	1.53
8300	Mini Warehouse	3,647,311	1.83	3,333.31		
6800	Mortuary	232,410	1.90	220.95		
6000	Auditorium	648,148	1.96	634.34		
5800	Bowling Alley	517,402	2.02	522.87		
5900	Arena	629,811	2.08	653.66		
7100	Transport Terminal	20,866	2.09	21.85		
5400	Nursing Home	3,577,707	2.17	3,888.44		
8800	Technical Manufacturing	2,463,657	2.22	2,739.54		
8200	Distribution Warehouse	4,030,792	2.25	4,539.82		
	Office	34,481,734	2.52	43,372.43		
5200	Medical Office	3,000,050	2.97	4,450.81		
5300	Hospital	2,084,563	3.62	3,772.44		
9200	Educational/Religious	3,987,059	3.71	7,387.91		
7500	Auto Sales/Service	1,428,107	3.85	2,750.12		
3400	Strip Store	8,561,805	4.00	17,120.61		
	Hotel/Motel/Resort	8,782,545	4.28	18,806.05	T	288,209.47
8000	Light Manufacturing	5,545,571	4.58	12,701.12	%	64.25%
6900	Clubhouse	4,567,293	4.87	11,111.96	R	4.17
3600	Discount Store	7,054,986	4.92	17,352.22		
8600	Barns	304,336	5.17	787.10		
8400	Warehouse	24,439,218	5.20	63,497.72		
	Shopping Centers	8,942,453	5.34	23,879.38		
7300	Nursery/Daycare	865,215	5.63	2,434.95		
8700	Pre-Fab Metal Building	35,368	5.73	101.24		
8500	Aircraft Hangar	121,493	6.10	370.55		
6300	Branch Bank	797,407	6.22	2,478.07		
6600	Vehicle Sales/Repair	3,660,377	6.53	11,955.81		
6500	Garage	247,977	6.61	819.64		
6700	Service Shop	1,008,578	6.74	3,399.74		
3500	Retail Shop	4,656,096	7.47	17,402.10		
9000	School	122,542	7.68	470.43		
1700	Dormitory	1,546,802	8.10	6,265.14		
6100	Theater	745,758	8.46	3,155.73		
5500	Bar/Nightclub	729,894	12.37	4,515.35		
7000	Cold Storage/Packaging	279,384	13.34	1,864.04		
	Automobile Service	389,516	16.21	3,157.04	T	148,909.56
4200	Supermarket	4,134,531	16.35	33,793.64	%	33.20%
4300	Convenience Store	739,287	21.33	7,886.05	R	22.09
5600	Restaurant	6,452,720	25.58	82,516.27		
5700	Fast Food Restaurant	758,363	40.03	15,177.17		

The generation rates of the majority of businesses are actually higher or lower than their classification average, which in many cases, places their generation above or below the average generation rates of business classifications ranked higher or lower, respectively, than the classification they are in. In other words, if the generation rates of individual business were plotted along a waste generation rate continuum, with a different color for each business classification, one would see a considerable amount of overlap across classifications.

As with any attempt to group multiple categories into broader classes, subjective factors come into play. Due to the nature of averages, unavoidably, businesses whose calculated generation falls at the bottom of a class range will be billed based on an average rate that exceeds their calculated generation, while businesses whose calculated generation falls at the top of the range will be billed based on a lower average generation rate. Not differentiating between the business classifications above and below a significant break in the data would provide a windfall to those above the break in the form of an annual assessment significantly lower than their generation suggests, and just the opposite for those business classifications below the break.

The first step was to identify significant breaking points in the data. Two breaking points were identified between PA code 6100 (8.46 Lbs/SF) and PA code 5500 (12.37 Lbs/SF) and between PA codes 5600 (25.58 Lbs/SF) and 5700 (40.03 Lbs/SF). These two breaking points potentially define two upper categories. The first boundary, at just above 12 pounds per square foot, is in roughly the same position as was recommended in the previous study. The large difference between the restaurant and fast food restaurant categories, which was not so significant in the prior study, appears to indicate the potential for the addition of another generator grouping, although this is not recommended.

First, placing a break between restaurants and fast food restaurants would create a category with only one business classification, which fails to recognize the natural variations within the classification discussed above. Further, even though the break is significant, the square footage in the fast food restaurant category is very low and the rate impact on the other high generators resulting from the inclusion of fast food restaurants with the other high generators is very small.

Coincidentally, all of the business classifications above the proposed boundary at 12 pounds per square foot are currently ranked in the high generator category based on the DUS study. Two classifications currently in the high category, transport terminals and aircraft hangars, are not in the high category based on this study.

Although relatively large breaks in the data can be seen at the high generation levels, no real discernible breaks can be seen in the balance of the data, which ranges from .30 pounds per square foot to 8.46 pounds per square foot. For this reason, although adding an additional category to further differentiate the classifications in this range was considered, the idea was ultimately abandoned.

Based on the results of the previous study, the boundary for the low generator category was placed at 2.00 pounds per square foot. Because there is no steadfast mathematical means to calculate where the break point should be and because the study results do not indicate any reason for a change, the low generator category is presented consisting of all classifications with average generation rates less than or equal to 2.00 pounds per square foot.

Also coincidentally, all of the business classifications previously classified as low generators are low generators based on this study. As a result of decreased generation rates, banks, department stores, mini warehouses, mortuaries, and auditoriums have moved into the low generator category. Additionally, due to

increased differentiation, hospitals with incinerators have moved into the low generator category, while other hospitals remain in the medium category.

3.6 Changes from Previous Study Results

A comparison of the results from this study to those from the previous commercial generation study is presented on Page 32. Of the 47 commercial categories for which a comparison can be made, the estimated average generation rate decreased for 42 and increased for 5. Some of the decreases can be attributed to the increase in commercial recycling, as many commercial entities are diverting recyclable materials toward recycling markets and out of the municipal solid waste stream.

The largest decreases occurred in department stores and transport terminals. The calculated average generation rate for department stores decreased from 13.52 to 1.72 pounds per square foot and from 146% to 27% of the mean generation rate. The generation rate for transport terminals decreased from 46.34 to 2.09 pounds per square foot and from 501% of the mean generation rate to 33% of the mean generation rate, largely as a result of the transfer of the higher generators to the agricultural classification. The most significant increase occurred in the fast food restaurant category. The calculated average generation rate increased from 23.76 pounds per square foot to 40.03 pounds per square foot and from 257% to 633% of the mean generation rate.

For the entire study, the average generation rate decreased from 6.60 to 5.38 pounds per square foot, a decrease of 18%. Although this is a considerable decline, the aggregate generation predicted by the study still appears to be higher than the amount of commercial waste the Authority receives, although the difference is significantly lower. The reason for the discrepancy is unknown, although loss of material across the border is a possibility. The estimated commercial generation from this study is 448,557 tons, versus 549,296 tons in the original study, based on approximately equivalent square footage.

The estimated quantity of solid waste generated by high generators as a percent of total commercial generation has increased from approximately 24% in the original study to 33% in the 1993 study. The total estimated quantity of solid waste from the high generator category is 148,910 tons, versus 133,521 tons in the original study, an increase of 12%. This increase coupled with a decrease of 28% in the estimated solid waste generation from the low and medium generator categories caused the shift in the relative generation toward the high generator category. The force behind this shift is a 13% increase in the average generation rate for the high generator category from 19.53 to 22.09 pounds per square foot, versus a 28% decrease in the average generation rate for the combined low and medium generator categories from 5.44 to 3.91 pounds per square foot.

The increase in the average generation rate for the high category is the result of two factors. First, the restaurant square footage increased from 1,972,517 to 6,452,720 due to an increase in restaurant space and the break-out and transfer of embedded restaurant space, the impact of which has already been reflected in the rates. Second, the increase in the average generation rate for fast food restaurants increased the average generation rate by 1.36 pounds per square foot. In the absence of these two events, the average generation rate for the high generator category would be 18.99 pounds per square foot.

4.0 Summary and Concluding Comments

This report presented the results of the 1993 Commercial Generation Study, the category ranking, and the three categories of commercial classifications to be used in the assessment billing program. The following comments relate to significant findings.

The results of this study validate the conclusions of DUS consultants in the original study regarding the variability of generation rates within business classifications and the continuing need for a variable component in the commercial billing program.

The average solid waste density calculated during the study was 158 pounds per cubic yard. When adjusted for empty container volume, the average calculated solid waste density was 134 pounds per cubic yard, which coincidentally, is the same as was calculated in the original study.

Due to the difficulty in gathering the data necessary to calculate density, it has been suggested that the process could be speeded up significantly if the waste densities were calculated by weighing the container full using a scale equipped front-end loader collection vehicle, tipping the waste, and weighing the container empty, thus eliminating the need to visit each business twice. Given the fact that the net weight of the total waste measured to calculate density was 243 tons and that the tipping fees would have totalled only $9,720 using the Authority's current tipping fee, this approach is recommended for future studies.

Finally, I would like to thank the Solid Waste Authority Customer Information Services personnel involved in the study for their hard work in collecting all of the data necessary to complete the study. I would especially like to thank Lynn Bestul for the excellent manner in which he coordinated the data collection activities.

1993 Commercial Generation Study
Comparison to Previous Study Results

		DUS	Ratio to Average	New	Ratio to Average	Difference	Percent Difference
1700	Dormitory	9.37	101.21%	8.10	128.13%	(1.27)	-13.52%
3400	Strip Store			4.00	63.27%		
3500	Retail Shop	9.35	101.06%	7.47	118.16%	(1.88)	-20.13%
3600	Discount Store	6.18	66.81%	4.92	77.83%	(1.26)	-20.43%
3700	Department Store	13.52	146.11%	1.72	27.21%	(11.80)	-87.28%
3800	Neighborhood Shopping Center	7.69	83.10%	5.34	84.47%	(2.35)	-30.56%
3900	Community Shopping Center	7.69	83.10%	5.34	84.47%	(2.35)	-30.56%
4000	Shopping Center Regional	7.69	83.10%	5.34	84.47%	(2.35)	-30.56%
4100	Shopping Center Super Regional	9.58	103.49%	5.34	84.47%	(4.24)	-44.24%
4200	Supermarket	16.55	178.83%	16.35	258.63%	(0.20)	-1.20%
4300	Convenience Store	35.11	379.42%	21.33	337.41%	(13.78)	-39.25%
4400	Hotel	5.15	55.70%	4.28	67.70%	(0.87)	-16.97%
4500	Hotel/Motel/Resort	5.15	55.70%	4.28	67.70%	(0.87)	-16.97%
4600	Low Rise Motel	5.15	55.70%	4.28	67.70%	(0.87)	-16.97%
4700	High Rise Motel	5.15	55.70%	4.28	67.70%	(0.87)	-16.97%
4800	Office-Low Rise	3.85	41.55%	2.52	39.86%	(1.33)	-34.46%
4900	Office-High Rise	3.85	41.55%	2.52	39.86%	(1.33)	-34.46%
5100	Office Condo	3.85	41.55%	2.52	39.86%	(1.33)	-34.46%
5200	Medical Office	4.76	51.44%	2.97	46.98%	(1.79)	-37.61%
5300	Hospital	3.10	33.48%	3.62	57.26%	0.52	16.83%
5301	Hospital with Incinerator			1.32	20.88%		
5400	Nursing Home	6.82	73.66%	2.17	34.33%	(4.65)	-68.17%
5500	Bar/Nightclub	15.25	164.83%	12.37	195.67%	(2.88)	-18.90%
5600	Restaurant	25.58	276.38%	25.58	404.64%	0.00	0.01%
5700	Fast Food Restaurant	23.76	256.75%	40.03	633.21%	16.27	68.47%
5800	Bowling Alley	4.49	48.55%	2.02	31.95%	(2.47)	-55.04%
5900	Arena	3.63	39.27%	2.08	32.90%	(1.55)	-42.76%
6000	Auditorium	8.46	91.47%	1.96	31.00%	(6.50)	-76.85%
6100	Theater	13.46	145.50%	8.46	133.82%	(5.00)	-37.17%
6200	Bank	3.93	42.46%	1.33	21.04%	(2.60)	-66.15%
6300	Branch Bank	7.58	81.88%	6.22	98.39%	(1.36)	-17.91%
6400	Service Station	27.34	295.41%	16.21	256.42%	(11.13)	-40.71%
6500	Garage	9.89	106.84%	6.61	104.56%	(3.28)	-33.15%
6600	Vehicle Sales/Repair	8.38	90.56%	6.53	103.29%	(1.85)	-22.08%
6700	Service Shop	10.52	113.69%	6.74	106.62%	(3.78)	-35.94%
6800	Mortuary	2.99	32.26%	1.90	30.06%	(1.09)	-36.37%
6900	Clubhouse	7.49	80.97%	4.87	77.04%	(2.62)	-35.01%
7000	Cold Storage/Packaging	12.31	133.02%	13.34	211.02%	1.03	8.37%
7100	Transport Terminal	46.34	500.72%	2.09	33.06%	(44.25)	-95.49%
7200	Parking Structure	0.35	3.80%				
7300	Nursery/Daycare			5.63	89.06%		
7500	Auto Sales/Service	8.38	90.56%	3.85	60.90%	(4.53)	-54.06%
7700	Exceptional Office	3.85	41.55%				
8000	Light Manufacturing	4.80	51.90%	4.58	72.45%	(0.22)	-4.64%
8100	Heavy Manufacturing	2.08	22.52%	1.50	23.73%		
8200	Distribution Warehouse	5.69	61.49%	2.25	35.59%	(3.44)	-60.46%
8300	Mini Warehouse	2.51	27.09%	1.83	28.95%	(0.68)	-27.01%
8400	Warehouse	5.69	61.49%	5.20	82.26%	(0.49)	-8.61%
8500	Aircraft Hangar	8.63	93.29%				
8600	Barns	12.97	140.17%	5.17	81.78%	(7.80)	-60.14%
8700	Pre-Fab Metal Building			5.73	90.64%		
8800	Technical Manufacturing	4.80	51.90%	2.22	35.12%	(2.58)	-53.78%
9000	School	5.61	60.57%	7.68	121.49%	2.07	37.01%
9100	Churches	1.70	18.42%	1.03	16.29%	(0.67)	-39.56%
9200	Educational/Religious	3.93	42.46%	3.71	58.69%	(0.22)	-5.59%
9201	Museums			1.12	17.72%		
	Mean	9.25		6.32			