

**STUDENT GENERATION
MULTIPLIER STUDY**

SCHOOL BOARD OF
PALM BEACH COUNTY

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Introduction:

In June 2000, Palm Beach County School District entered into an interlocal agreement with 26 municipalities in Palm Beach County and the County to establish public school concurrency. As a condition of this agreement the School District agreed to develop and apply student generation multipliers. The multipliers will be utilized to project public school students, by level (elementary, middle, high) from proposed residential development. This study fulfills the commitment made in the interlocal agreement to develop student generation multipliers.

The school district currently uses student generation multipliers shown in Appendix 1. These multipliers were calculated in a 1986 study by deHaven –Smith¹. Other comparative studies include Nicholas 1995², Schultz 1999³, Thompson 2000⁴, Tischler & Associates 2000⁵, Wittman et al. 1993 & 1997⁶ and Zabik 2000⁷

Methodology:

District staff obtained the best available data to update student generation multipliers. Based upon the date of previous studies and the desire to formulate multipliers based upon recently occupied new residential dwelling units, it was determined that units occupied in calendar years 1999 and 2000 would be sampled. Addresses of sample dwelling units were matched to the fall 2001 public school K-12 student address list. The methodology for the multiplier study was reviewed by Intergovernmental Plan Amendment Review Committee (IPARC) members, by the population sub-committee and by representatives of and consultants for the South Florida Home Builders Association.

The methodology included the following components:

1. Addresses of “substantially complete” residential units by type were obtained from the Palm Beach County Property Appraisers database. The property appraiser conducts a “substantially complete” survey of properties that are ready for occupancy prior to entering them into their database. The Property Appraiser database does not contain information on certificates of occupancy. Therefore, in this study, a “substantially complete” designation was used as a proxy for a certificate of occupancy (CO). The intent is to ensure that residential units sampled are occupied before fall 2001.

Student generation multipliers were determined for four housing unit type categories: single family; multifamily (not including apartments or high rise units); apartments; and, high rise units. This study did not differentiate between affordable apartment housing and other apartment housing. Accurate, complete data regarding the number of bedrooms in residential housing units was not available. Therefore, student multipliers by unit type and number of bedrooms were not calculated in this study. Single-family types include single-family

detached homes and zero-lot-line homes. Multi-family types include townhouses, villas, duplexes, condominiums (other than high rise condominiums), fourplex units and other multi-family types. Apartments are rental apartment units, three stories or less. High-rise housing units are condominiums or rental units in buildings of four stories or more.

2. Total single-family, multi-family and apartment housing units occupied in 1999 and 2000 were sampled based upon the statistical formula shown in Appendix 2. Dr. Ronald Schultz, Professor at Florida Atlantic University, reviewed the sample size calculation. All high-rise units occupied in 1999 and 2000 were sampled due to the relatively small number of units in this category. Municipalities in the county and county staff were surveyed to determine high-rise units built and occupied during the study period.

The sample size was determined with a desired level of accuracy of +/- 5 students in every 100 housing units. In a practical sense this means that if samples were drawn repeatedly from the population of housing units, the calculated multiplier would be plus or minus five students from the actual number of student residing in every 100 housing units.

3. The addresses of dwelling units occupied in 1999 and 2000 provided by the Property Appraiser were checked and verified. Addresses located in adult communities exempt from impact fees were removed from the population of addresses to be sampled. Random numbers were generated to draw samples from each housing unit category using a random number generator function. Apartment addresses provided by the Property Appraiser did not provide addresses of individual apartment units. Therefore, data provided by United States Postal Service personnel and verified with individual apartment leasing office staff were used to determine apartment unit addresses.
4. Sample addresses were matched to fall 2001 student addresses using Microsoft Access software. Addresses were also checked manually against the student address database. Data entry mistakes were identified and corrected to ensure accuracy in matching sample housing units to student addresses.

Results:

Table 1 lists information regarding the number of housing units by type that were occupied during the study period. The adjusted total is the number of dwellings after discounting bad addresses and units located in adult communities. Just fewer than 25,000 total units were occupied during the study period (1999 & 2000). Of these, 920 addresses were found to be in adult communities and/or were inaccurate or non-verifiable addresses. Therefore, the adjusted total is 24,024 dwelling units. Fifty-nine percent or 14,162 units were single-family homes; 5418 units were apartments; 3526 units were multi-family units; and, 918 units were high-rise units.

Table 1 also lists the calculated sample size for each housing unit category. The sample included 815 single-family houses, 745 apartment units and 694 multi-family units. As stated earlier, because of the relatively small number of high-rise units, all high-rise units were surveyed.

Table 2 lists the derived student generation multipliers. The study results show that single-family homes generated the most students per unit of any of the four housing groups. The calculated student generation multiplier was 0.29 K-12 students per single-family house or 29 students in every 100 single-family homes. Apartments generated 21 students (K-12) in every 100 apartments and multi-family housing types (townhouses, villas, duplexes, condominiums) generated 18 students per 100 dwelling units.

Each housing unit type generated more elementary students than middle or high school students. Every 100 single-family homes generated 15 elementary students according to the study. The derived multipliers were 11 elementary students per 100 apartment units and 8 elementary students per 100 multi-family units.

The student generation multipliers for middle and high school students were lower than elementary generation rates. The study determined that every 100 single-family homes generate, on average, 6 middle school students and 8 high school students. Apartments produce 0.05 middle school and 0.05 high school students per unit. Multi-family housing (excluding apartments and high-rise units) generate 0.04 middle school and 0.06 high school students per dwelling unit.

High-rise dwellings had 20 total K-12 students in 918 units or 0.01 elementary students per unit, 0.002 middle school students per unit and 0.01 high school students per unit.

Discussion:

The student generation multipliers derived in this study represent an average generation rate based upon housing built and occupied throughout Palm Beach County during 1999 and 2000. Any individual development may have a higher or lower student generation rate. Previous studies calculated multipliers based upon housing unit types and the number of bedroom in the units. This study design did not include multipliers for housing based upon the number of bedrooms due to the lack of accurate, available data. As noted in the methodology section, no differentiation was made in the study between affordable housing apartments and other apartments.

Table 3 compares the student generation multipliers derived in this study to generation rates in two previous studies. The two studies are the 1986 study by deHaven-Smith and the 1999 study by Schultz. The multipliers currently utilized by the district are from the deHaven-Smith 1986 study.

As shown in Table 3, the single-family multiplier for elementary students from this study, 0.15 per unit, was close to the 1987 study multiplier for a three bedroom single-family home, 0.17 per unit. The deHaven-Smith elementary multiplier for single-family units

with more than three bedrooms was 0.4 per unit. Multipliers for middle and high school students in 1986 were higher both for three bedrooms and more than three bedrooms than multipliers derived in this study.

Comparison of the multi-family multipliers between the two studies (current study and deHaven) shows the same pattern as the single-family generation rates. Elementary rates are close to the three bedroom single-family multiplier in the 1986 study. Middle and high generation rates were higher in 1986 than today. One hundred multi-family three-bedroom units in 1986 produced 16 middle school and 16 high school students. This study shows lower multi-family multipliers of five middle school and five high school students per 100 units. The deHaven-Smith study reported no students generated in mid-rise multi-family (3 stories) or high-rise multi-family.

The derived student generation multipliers are very similar to the multipliers reported by Schultz in 1999. Table 3 shows this comparison. Schultz's study calculated an average multiplier without reference to the number of bedrooms. This study derived 29 K-12 students per 100 single-family homes. Schultz found 31 K-12 students per 100 units. The multipliers by level (elementary, middle and high) are also quite close. The derived elementary single-family multiplier from this study is 0.15 per unit. The Schultz multiplier was 0.16 per home. This study found 0.06 middle school and 0.08 high school students per single-family home. Schultz derived 0.08 per unit middle school and 0.07 per unit high school.

The multipliers for multi-family units in the 1999 Schultz study are identical to those derived in this study except for high school students which differed by two students per 100 housing units. Apartment multipliers derived by district staff were somewhat higher than the Schultz multi-family generation rates.

An explanation for why the student generation multipliers have changed from the late 1980's, particularly for middle and high school students was beyond the scope of this study. It may be that in the fifteen years between the deHaven-Smith analysis and today's study the housing choices have shifted from new to existing housing. Additionally, the percentage of "empty-nesters" in the housing market is higher today than in 1987. As the baby-boom generation continues to age more people are reaching their mid to late fifties. These families, many of which longer include school age children, may be purchasing new multi-family housing.

TABLE 1

Housing Units, By Type			
Housing Type	Total	Adjusted Total	Sample Size
Single Family	14,589	14,162	815
Multi-Family	3,560	3,526	694
Apartments	5,877	5,418	745
High Rise	918	918	918
Total	24,944	24,024	3,172

SingleFamily - single family/ zero lot line

Multi-Family - townhouse,villa,duplex,fourplex, condominium,other multi-family

Apartments - rental apartment units three-story buildings or less

High Rise - rental apartment and condominium units in buildings of four-stories or more

TABLE 2

Student Generation Multipliers*				
Housing Type	Elem	Middle	High	Total
	K-5	6-8	9-12	K-12
Single Family	0.15	0.06	0.08	0.29
Multi-Family	0.08	0.04	0.06	0.18
Apartments	0.11	0.05	0.05	0.21
High Rise	0.01	0.002	0.01	0.022

* February 2002 Study

Table 3

Housing Unit Type	Study Year	Number of Bedrooms	Elem	Middle	High	Total
			K-5	6-8	9-12	K-12
SINGLE-FAMILY UNITS						
Current Study	2002	average	0.15	0.06	0.08	0.29
deHaven-Smith Study	1987	3 bedrooms	0.17	0.12	0.23	0.53
deHaven-Smith Study	1987	more than 3 bedrooms	0.40	0.17	0.15	0.72
Schultz Study	1999	average	0.16	0.08	0.07	0.31
MULTI-FAMILY UNITS						
Current Study	2002	average	0.08	0.04	0.06	0.18
Current Study (apts.)	2002	average	0.11	0.05	0.05	0.21
deHaven-Smith Study	1987	3 bedrooms	0.05	0.16	0.16	0.38
deHaven-Smith Study	1987	more than 3 bedrooms	0.33	0.00	0.33	0.66
Schultz Study	1999	average	0.08	0.04	0.04	0.16
HIGH-RISE UNITS						
Current Study	2002	average	0.01	0.002	0.01	0.022
deHaven-Smith Study	1987	3 bedrooms	0.00	0.00	0.00	0.00
deHaven-Smith Study	1987	more than 3 bedrooms	0.00	0.00	0.00	0.00

Notes:

This current study derived a student generation multiplier for two multi-family categories, multi-family & rental apartments. Both multipliers are shown under Multi-Family units in Table 3. The deHaven-Smith study surveyed single-family detached and attached units. The multipliers from his study are shown under Single-Family units in Table 3; The deHaven-Smith study surveyed three categories of multi-family - low rise two stories, mid-rise three stories and high-rise four plus stories. The multipliers from his study for low-rise two stories are shown under Multi-Family units in Table 3. The multipliers from his study for high-rise four plus stories are shown under High-Rise units in Table 3. The multipliers for mid-rise three stories derived in the deHaven-Smith study were all zero.

The Schultz study derived multipliers for single-family dwellings and multi-family dwellings. Multipliers were not calculated based upon the number of bedrooms, the number of stories in multi-family residential buildings or for high-rise units in the Schlutz study.

REFERENCES:

1. deHaven-Smith, L., (1986). Palm Beach County Demographic Multiplier Study. Prepared for Palm Beach County School Board, Florida. Florida Atlantic University/Florida International University Joint Center for Environmental and Urban Problems, Ft. Lauderdale , Florida.
2. Nicholas, J. C. PhD. (1995). Technical Memorandum on the Methods Used to Calculate the School Impact Fee, Prepared for the School Board of Martin County, Florida.
3. Schultz, R R., (1999). Palm Beach County Public School Generation Rates (Multipliers). Regional Research Associates, Boca Raton, Florida.
4. Thompson, C., (2000). Palm Beach County Affordable Housing. Thompson Consulting Inc. West Palm Beach, Florida.
5. Tischler, P. S., (2000). Review of Palm Beach County School District Pupil Generation Factors and the Effects on School Utilization. Prepared for the City of Palm Beach Gardens, Florida. Tischler & Associates Inc., Bethesda Maryland.
6. Wittman, A., et al. 1993. A Study of Broward County School Impact Fees. Property Management Site Acquisition Department, School Board of Broward County, Ft. Lauderdale Florida. and Wittman, A. et al. 1997 A Study of Broward County School Impact Fees, Update. Property Management Site Acquisition Department, School Board of Broward County, Ft. Lauderdale Florida.
7. Zabik, L., 2000. In Assisted Rental Housing Market Impact Study. Zabik & Associates, Royal Palm Beach, Florida.

Appendix 1

EXHIBIT D

Student Generation Multiplier Table

		TOTAL SAMPLE SIZE	PUBLIC SCHOOL K-12	PUBLIC SCHOOL K-5	PUBLIC SCHOOL 6-8	PUBLIC SCHOOL 9-12
ALL HOUSE TYPES						
1	BEDR	70	0.04	0.04	0.00	0.00
2	BEDR	252	0.12	0.08	0.02	0.01
3	BEDR	245	0.50	0.15	0.12	0.22
3+	BEDR	76	0.69	0.38	0.15	0.15
SING. FAMILY DETACHED AND ATTACHED						
2	OR LESS	123	0.19	0.14	0.03	0.00
3	BEDR	217	0.53	0.17	0.12	0.23
3+	BEDR	70	0.72	0.40	0.17	0.15
LOW RISE MULTI. FAMILY (2 STORIES)						
1	BEDR	28	0.00	0.00	0.00	0.00
2	BEDR	97	0.10	0.06	0.03	0.01
3	BEDR	18	0.38	0.05	0.16	0.16
3+	BEDR	3	0.66	0.33	0.00	0.33
MID RISE MULTI. FAMILY (3 STORIES)						
1	BEDR	13	0.00	0.00	0.00	0.00
2	BEDR	23	0.00	0.00	0.00	0.00
3	BEDR	1	0.00	0.00	0.00	0.00
3+	BEDR	0	0.00	0.00	0.00	0.00
HIGH RISE MULTI FAMILY (4 PLUS STORIES)						
1	BEDR	8	0.00	0.00	0.00	0.00
2	BEDR	19	0.10	0.00	0.00	0.10
3	BEDR	6	0.00	0.00	0.00	0.00
3+	BEDR	2	0.00	0.00	0.00	0.00
MOBILE HOME						
1	BEDR	1	0.00	0.00	0.00	0.00
2	BEDR	10	0.00	0.00	0.00	0.00
3	BEDR	3	0.00	0.00	0.00	0.00
3+	BEDR	1	0.00	0.00	0.00	0.00

APPENDIX 2

SAMPLE SIZE CALCULATION:

The following formula was utilized to calculate the required sample size:

$$n = \frac{Z^2 \cdot s^2}{(x-u)^2 + \frac{Z^2 \cdot s^2}{N}}$$

n = calculated sample size

Z = the factor representing probability that the confidence interval will bracket the true mean (normal distribution)

s² = variance

x-u = confidence interval

N = population

Example:

N = 14,162 single-family dwelling units (occupied in 1999 & 2000)

Z = 1.96 (95% confidence level)

s² is estimated by the range of 0 to 3 students per new unit (previous studies). The range is approximately equal to 4 standard deviations (4) by the empirical rule, one fourth of the range approximates . One-fourth of 3 is 0.75.

x - u It is desired that the derived multiplier estimate +/- 5 students in every 100 housing units.

Therefore,

$$n = \frac{(1.96)^2 (0.75)^2}{(0.05)^2 + \frac{(1.96)^2 (0.75)^2}{N}}$$

$$= \frac{2.1609}{0.0026525}$$

$$= 815 \text{ calculated sample size single-family dwelling units}$$