



National Fire Protection Association

The authority on fire, electrical, and building safety

***Comparative Analysis of Housing Cost
and Supply Impacts of Sprinkler Ordinances
at the Community Level***

Final Report

June 2009

Table of Contents

I. Executive Summary	1
II. Purpose	3
III. Approach	3
IV. Overview of Enacted Sprinkler Requirements	7
V. Impact Analysis Based On Housing Data	8
VI. Construction Industry and Regulatory Analysis	18
VII. Conclusion	19
Appendix A - Communities Considered for the Comparative Analysis of Housing Cost and Supply Impacts of Sprinkler	21
Appendix B - Major Ordinances Impacting Housing Construction in Comparison Counties	24

Table of Figures

Figure 1: Map of Counties Studied in Maryland and Virginia.....	1
Figure 2: Select Demographic Data of Comparison Counties	5
Figure 3: Attached Single-Family Housing Stock in 1990 and 2000.....	9
Figure 4: Annual Single-Family Construction Permits Issued in Montgomery, Fairfax, Prince George's and Anne Arundel Counties from 1980 to 2007	10
Figure 5: Comparison of Single-Family Construction Permits Issued in Montgomery and Fairfax Counties from 1980 to 2007	12
Figure 6: Comparison of Single-Family Construction Permits Issued in Anne Arundel & Prince George's Counties from 1980 to 2007	12
Figure 7: Total Single-Family Detached Housing Units by Year Built.....	14
Figure 8: Attached Percentage of Single-Family Housing Units by Year.....	14
Figure 9: National Totals and Percentage with Sprinklers Installed by Type of Housing	16
Figure 10: Percentage of Total Housing Units with Residential Sprinklers for Selected Areas as of 2007	17
Figure 11: Percentage of Housing Units with Sprinklers by Year Constructed.....	18

Comparative Analysis of Housing Cost and Supply Impacts of Sprinkler Ordinances at the Community Level

I. Executive Summary

A study of select jurisdictions was conducted to determine the housing cost and supply impacts of residential sprinkler ordinances at the local level. After considering over 100 jurisdictions and surrounding areas, the Washington D.C. suburban counties of Anne Arundel, Montgomery and Prince George's Counties, Maryland, and Fairfax County, Virginia were selected for a comparison study to determine the market effects of fire sprinkler system installation requirements. Montgomery County, Maryland a jurisdiction with sprinkler requirements was paired with Fairfax County, Virginia, a jurisdiction without requirements. Prince George's County, Maryland, a county with sprinkler requirements dating back to 1987 was paired with Anne Arundel County, Maryland. Anne Arundel County had a state-imposed townhome requirement dating from 1990 but no single-family detached requirement until 2009¹.



Figure 1: Map of Counties Studied in Maryland and Virginia Shown in Gold and Green

The selected counties (shown in Figure 1) were deemed the best demographic matches to compare the housing characteristics of jurisdictions with sprinklers to those without sprinklers. The selection allowed the comparison of municipalities that cover a

¹ In 1989 the State of Maryland enacted House Bill 658, "Sprinkler Systems – Installation in New Construction", that required dormitories, hotels, lodging or rooming houses, multifamily residential dwellings **and townhouses** to be sprinklered. Therefore, since 1990, all townhouses in Maryland have been sprinklered. The comparison county, Prince George's County, implemented sprinklers in townhomes in 1989. Additionally, Anne Arundel County passed an ordinance January 5, 2009 requiring residential sprinklers in all new single-family dwellings. The data analyzed in this report precedes the passage of this ordinance.

relatively wide geographic area with a variety of housing stock and income levels. In terms of development, all four selected counties are relatively mature

The study included collecting and analyzing single-family permit data available through the U.S. Census and published and unpublished data from the 1990 and 2000 decennial Census of Population and Housing, the 2007 American Community Survey (ACS), and the 2007 American Housing Survey (AHS). The data was supplemented with a review of the regulations that impacted housing in the selected areas from 1989 through 2009. Interviews were conducted with local government staff, housing industry professionals, and selected home builders to enhance the quantitative findings with qualitative analysis.

Key Findings

In the late 1980's, residential sprinkler ordinances began to be enacted in Prince George's and Montgomery Counties. After each update of these municipalities' sprinkler rules, there were no corresponding reductions in the number of single-family homes built in either county, relative to their neighboring counties in Maryland and Virginia. In each instance, these municipalities actually saw a larger relative increase in construction in the year after regulations became effective, compared to the adjacent counties without sprinkler ordinances.

In the interviews conducted with builders and the Maryland-National Capital Building Industry Association (MNCBIA), there were repeated references to other regulations and building fees in all the counties studied. Interviewees felt that these other requirements dwarfed any cost effects from the sprinkler installation requirements.

In summary, the following analysis did not reveal that the enactment of sprinkler ordinances caused any detrimental effects on housing supply and costs. The data reviewed indicates that sprinkler system requirements were a minor influence on regional housing costs compared to fees and other rules, population and job growth, and land availability.

II. Purpose

The purpose of this research was to investigate whether the imposition of sprinkler ordinances within a jurisdiction had a measureable impact on the housing construction or prices in that municipality relative to comparable nearby communities without such an ordinance.

III. Approach

After considering a wide range of potential communities that had enacted residential sprinkler ordinances (Appendix A), Newport paired together four jurisdictions to compare the impact of sprinkler requirements on the price and supply of housing: Montgomery County, Maryland and Fairfax County, Virginia; and, Prince George's County, Maryland and Anne Arundel County, Maryland. Sprinkler ordinances were enacted in Montgomery and Prince George's County beginning in the late 1980's.

The counties considered in this study are long-established suburban jurisdictions located near Washington DC. Montgomery County, Maryland, and Fairfax County, Virginia, are particularly comparable in terms of population size and characteristics. The two counties are both among the top ten in the nation in terms of median household income. The median values for both income and house prices are slightly higher in Fairfax County, which also has a slightly larger population. In both counties, the share of people age 25 and over in 2000 with at least a college degree was 55 percent.

Although some residents of Fairfax and Montgomery Counties work in the District of Columbia or commute to other area jurisdictions, most of the employed residents in each county also work within their county. Nearly as many workers commute into those counties as commute out. In 2000, the ratio of jobs to workers exceeded 90 percent in both counties.

Although employment in both counties is heavily oriented toward management and professional activities, and the two counties often compete to attract the same businesses, there are some differences in industrial composition that may affect employment growth and construction activity. Fairfax has a greater concentration of employment related to telecommunications, defense, and computer software. Montgomery (home to the National Institutes of Health) has more employment related to life sciences. In both counties, over 13 percent of workers are employed by the federal government.

Prince George's County is located on the eastern border of the District of Columbia. Anne Arundel County is further east, situated between Prince George's and the Chesapeake Bay. Households in Anne Arundel, on average, are a bit wealthier and more highly educated than those in Prince George's, but the two counties are generally similar. In Anne Arundel, 31 percent of the population age 25 and over in 2000 were college graduates, compared to 27 percent in Prince George's. Median Household Income in 1999 was \$62,000 in Anne Arundel and \$55,000 in Prince George's. Median owner-occupied home values in 2000 were \$157,000 for Anne Arundel and \$144,000 in Prince George's.

In Prince George's County, 31 percent of all civilian workers in 2000 were government employees, including 18 percent who worked for the federal government. In Anne Arundel, 22 percent were government civilian employees, with 11 percent working for the federal government. In Anne Arundel, however, another 4.2 percent of the total labor force was in the military, compared to 1.6 percent in Prince George's.

Anne Arundel County is actually classified as part of the Baltimore-Towson Metropolitan Statistical Area (MSA) rather than the Washington-Arlington-Alexandria MSA, although its ties to the Washington metropolitan area are quite strong. In fact, of workers commuting to jobs outside the county, the number working in the Washington metropolitan area exceeds the number working in other counties of the Baltimore metropolitan area.

Prince George's County is somewhat more of a "bedroom" community, with a 2000 ratio of jobs to workers of 74 percent, compared to 88 percent in Anne Arundel.

Figure 2: Select Demographic Data of Comparison Counties

	Anne Arundel County, MD	Prince George's County, MD	Montgomery County, MD	Fairfax County, VA	U.S.
Population					
1980	370,775	665,071	579,053	596,901	226,545,805
1990	427,239	729,268	757,027	818,584	248,709,873
2000	489,656	801,515	873,341	969,749	281,421,906
2007	510,507	825,318	941,491	1,004,151	301,290,332
Annual Growth Rate					
1980-1990	1.43%	0.93%	2.72%	3.21%	0.94%
1990-2000	1.37%	0.95%	1.44%	1.71%	1.24%
2000-2007	0.58%	0.40%	1.04%	0.48%	0.95%
Workers in 2000					
Working in County	225,115	295,286	420,875	506,272	
Living in County	255,858	397,403	455,331	527,464	
Living and Working in County	144,033	155,671	267,128	278,064	
Median Household Income					
2000 Census data	\$61,768	\$55,256	\$71,551	\$81,050	\$41,994
2007 ACS data	\$80,402	\$68,370	\$91,835	\$105,241	\$50,740
Median Home Value					
2000 Census data	\$156,500	\$143,700	\$210,600	\$222,400	\$111,800
2007 ACS data	\$384,200	\$354,600	\$524,700	\$568,900	\$194,300
Education (Age 25+ in 2000)					
High School Grad	86.4%	84.9%	90.3%	90.7%	80.4%
College Grad	30.6%	27.2%	54.6%	54.8%	24.4%
Graduate or Professional Degree	11.5%	10.2%	27.5%	24.4%	8.9%

Sources: American Community Survey 2007, Census Bureau Annual Estimates of the Resident

Population for Counties (CO-EST2008-01-24), and Census of Population and Housing 1980, 1990, 2000.

The selection of these four counties allowed the comparison of municipalities that cover a relatively wide geographic area with a variety of housing stock and income levels. In terms of development, all four selected counties are relatively mature.

The primary sources used in this analysis were as follows:

a. Annual single-family building permits

Permit data are the most geographically-detailed, time-specific measure of new construction. Permit data are collected by the U.S. Census Bureau

from more than 20,000 local government agencies.² Although it is possible for a permit to be issued without construction actually occurring, about 98 percent of single-family permits result in new construction, usually within a month of authorization.

b. Surveys of Housing and Households

The U.S. Census Bureau collects information about the housing stock from residents (or, for vacant units, from other informed sources) in connection with the decennial census and ongoing surveys. For this study, data were analyzed from the 1990 and 2000 decennial Census of Population and Housing, the 2007 American Community Survey (ACS), and the 2007 American Housing Survey (AHS). This provided information about the number of existing homes in each jurisdiction, when they were built, and other structural characteristics (particularly the number of detached and attached single-family homes).

The 2007 AHS also provided data on the number of homes with fire sprinklers. Such information was not available previously, and only limited information has been published. This report includes analysis of the AHS sprinkler data at the national level as well as for the counties in the study.

c. Contemporaneous documents and news reports

A search and analysis of local documents before and after residential sprinkler requirements were imposed was conducted. In particular, twenty years of monthly newsletters from the local home building trade association were obtained, digitized, and analyzed. This provided a detailed record of responses to sprinkler proposals and requirements, as well as information about the plethora of other regulations and influences on building activity.

d. Interviews with builders, trade association staff, and local government officials

Discussions with key individuals involved in the process provided numerous insights into the adoption and implementation of sprinkler

² Information about the Census Bureau's Building Permit Survey and the relationship to construction activity is available at <http://www.census.gov/const/www/newresconstindex.html> and <http://www.census.gov/const/www/permitsindex.html>

requirements as well as the other factors and events that influenced construction.

The fact that requirements are fairly recent, but no longer actively debated in the counties with requirements now in place contributed to the clarity and objectivity of the information provided by those interviewed.

Although every effort was made to document evidence of adverse effects from sprinkler requirements, none of the statistical or interview information demonstrated that the requirements led to reduced housing supply. Any increase in the cost of construction would logically mean higher costs for households, unless the full effect was absorbed in land values, but if there was an increase because of sprinkler requirements it was completely obscured by the effects of other changes.

IV. Overview of Enacted Sprinkler Requirements

Sprinkler requirements were implemented in several stages in each of the two test counties. This probably helped to cushion the impact and prevent disruptions. In particular, requirements were imposed on townhouses before they were applied to detached single-family houses. While townhouses and detached single-family homes were approached as separate tiers with the sprinkler requirements, the approach to applying sprinklers in both kinds of structures is essentially the same.

Prince George's County mandated sprinklers through legislation initially enacted in 1987. Under that legislation, model homes had to include sprinklers, beginning on February 1, 1988. Multifamily units were required to have sprinklers beginning June 30, 1988, and townhouses were covered as of January 1, 1989. Single-family detached homes were covered beginning January 1, 1992.

Sprinkler requirements for townhouses in Montgomery County became effective in November 1986. Beginning in July 1990 the county required that sprinklers be an option in single-family detached construction. This "mandatory option" required that at least one model home in a subdivision be equipped with sprinklers and that customers be offered an option to have sprinklers installed.

A tax credit for retrofits of sprinklers in existing homes in Montgomery County, worth up to half of the property tax in the year of installation, became effective July 1,

2000. The Montgomery County Council passed further legislation in October 2003, to be effective January 1, 2004, extending sprinkler requirements to all new single-family detached homes. Two municipalities in the county, Rockville and Gaithersburg, adopted sprinkler requirements for all single-family homes a year earlier.

V. Impact Analysis Based On Housing Data

Household survey information and data on permits for new construction were analyzed as to whether the introduction of sprinkler requirements was associated with changes in the volume, type or costs of construction. In every instance, after requirements became effective, there were no corresponding reductions in the number of single-family homes built in either Montgomery or Prince George's County, relative to their neighboring jurisdictions in Maryland and Virginia.

The single-family new construction permit data available from the U.S. Census does not distinguish between detached homes and attached single-family (townhouse) structures. The breakdown on the data that would allow separation of detached and attached is not readily available and would have to be collected from the individual jurisdictions. For example, in Montgomery County, the data would have to be obtained from Montgomery County as well as the cities of Rockville and Gaithersburg. The jurisdictions in the study did not have the data compiled and could not provide it in a timely manner; therefore, we relied on the combined data available from the U.S. Census.

In the areas studied, townhouses represent a large share of the single-family housing stock. Figure 3 shows the attached share of the single-family housing stock in 2000 for the U.S., for the States of Maryland and Virginia, and the District of Columbia, and for the counties considered in this study and other neighboring counties. In 2000, for the nation as a whole, 8.4 percent of the single-family housing stock consisted of attached units. In Montgomery and Prince George's Counties, the attached shares were 25.9 percent and 23.0 percent, respectively. For Fairfax and Prince William Counties in Virginia, and for Howard County in Maryland, the attached shares were even higher, while in Frederick and Anne Arundel Counties in Maryland the attached shares were slightly lower.

Figure 3: Attached Single-Family Housing Stock in 1990 and 2000

	1990			2000		
	Total Housing Units*	Single-Family (Attached & Detached) as % of Total Housing Units	Single-Family Attached as % of Single-Family Units	Total Housing Units*	Single-Family (Attached & Detached) as % of Total Housing Units	Single-Family Attached as % of Single-Family Units
United States	102,263,678	64.3%	8.2%	115,904,641	65.8%	8.4%
District of Columbia	278,489	38.0%	67.5%	274,845	39.7%	66.7%
Maryland	1,891,917	70.4%	29.8%	2,145,283	72.2%	29.1%
Anne Arundel Co.	157,194	80.9%	18.4%	186,937	81.3%	21.3%
Frederick Co.	54,872	79.7%	18.3%	73,017	82.8%	21.5%
Howard Co.	72,583	72.3%	28.0%	92,818	74.7%	28.0%
Montgomery Co.	295,723	68.9%	24.8%	334,632	69.1%	25.9%
Prince George's Co.	270, 090	61.4%	20.7%	302,378	65.2%	23.0%
Virginia	2,496,334	70.1%	12.5%	2,904,192	72.0%	13.4%
Arlington Co.	84,847	42.0%	24.2%	90,426	40.8%	25.0%
Fairfax Co.	307,966	73.9%	29.3%	359,411	73.3%	31.4%
Prince William Co.	74,759	80.1%	30.4%	98,052	80.7%	33.2%

*Total Housing Units includes single-family attached, single-family detached, multi-family housing, and manufactured housing.

Source: U. S. Census 1990 and 2000

Figure 4 shows the annual single-family permit numbers (single family attached and detached) for Montgomery and Prince George's Counties, and for the neighboring counties of Anne Arundel and Fairfax that are the controls in this study.

In 1987, the first full year in which Montgomery County required sprinklers in townhouses, the total number of permits issued for the construction of single-family units increased in Montgomery County, while there were declines in the number of permits issued in Fairfax, Prince William, and Anne Arundel Counties.

In 1989, when sprinklers were first required in townhouses in Prince George's County, although the county saw a decline in the number of single-family permits

issued, the percentage decline was smaller than in Montgomery or any of the neighboring control counties, which had no new requirements that year. The decline in activity throughout the region reflected broader national factors, including increases in mortgage rates and the savings and loan crisis.

There were also no relative declines in the issuance of single-family construction permits in either Prince George's County in 1992 when sprinkler requirements were imposed on detached homes, or in Montgomery County when detached homes were covered in 2004. In fact, in both instances, the issuance of single-family construction permits surged, in absolute terms and relative to neighboring counties. Although it is unlikely that the sprinkler ordinances actually stimulated construction activity, there is absolutely no indication from the permit data that the sprinkler requirements retarded single-family housing construction.

Figure 4: Annual Single-Family Construction Permits Issued in Montgomery, Fairfax, Prince George's and Anne Arundel Counties from 1980 to 2007

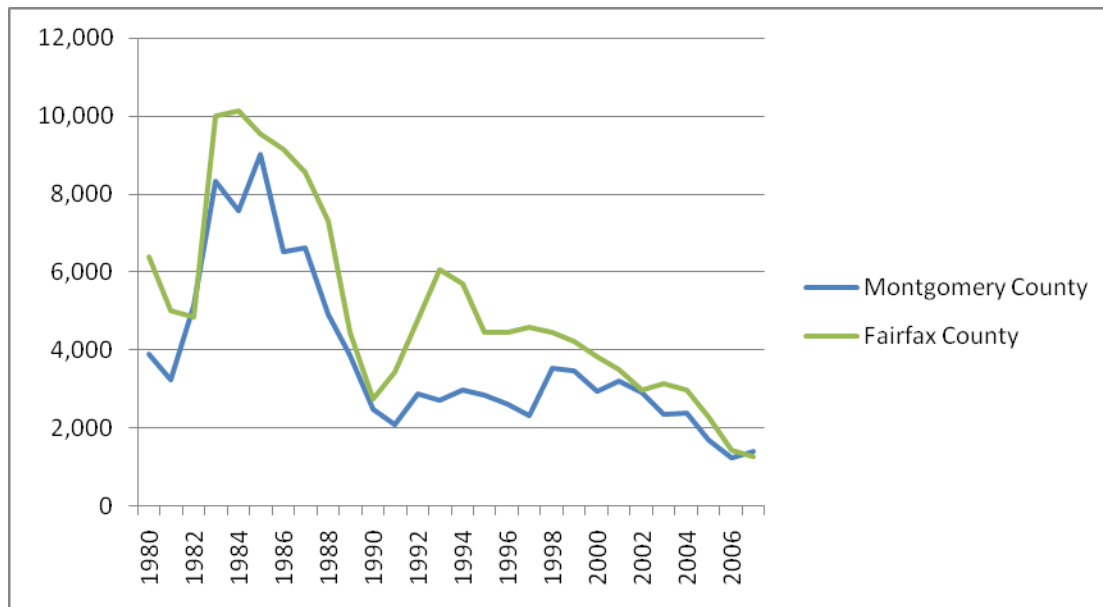
Year	Montgomery County		Fairfax County		Prince George's County		Anne Arundel County	
	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year
1980	3,892		6,393		1,693		2,293	
1981	3,245	-16.62%	5,003	-21.74%	1,655	-2.24%	1,630	-28.9%
1982	5,146	58.58%	4,843	-3.20%	1,751	5.80%	1,928	18.3%
1983	8,321	61.70%	9,989	106.26%	3,030	73.04%	4,690	143.3%
1984	7,563	-9.11%	10,123	1.34%	3,184	5.08%	3,119	-33.5%
1985	9,007	19.09%	9,533	-5.83%	3,520	10.55%	3,472	11.3%
1986	6,507	-27.76%	9,137	-4.15%	4,838	37.44%	3,687	6.2%
1987	6,622	1.77%	8,557	-6.35%	4,318	-10.75%	3,160	-14.3%
1988	4,922	-25.67%	7,314	-14.53%	5,051	16.98%	3,032	-4.1%
1989	3,848	-21.82%	4,455	-39.09%	4,427	-12.35%	2,089	-31.1%
1990	2,494	-35.19%	2,746	-38.36%	4,273	-3.48%	2,160	3.4%

	Montgomery County		Fairfax County		Prince George's County		Anne Arundel County	
Year	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year	Number of Permits	% Change from previous year
1991	2,081	-16.56%	3,430	24.91%	2,882	-32.55%	2,292	6.1%
1992	2,889	38.83%	4,791	39.68%	4,248	47.40%	3,435	49.9%
1993	2,707	-6.30%	6,047	26.22%	4,655	9.58%	3,309	-3.7%
1994	2,976	9.94%	5,688	-5.94%	3,800	-18.37%	2,913	-12.0%
1995	2,833	-4.81%	4,446	-21.84%	3,474	-8.58%	2,512	-13.8%
1996	2,616	-7.66%	4,436	-0.22%	3,072	-11.57%	2,429	-3.3%
1997	2,333	-10.82%	4,586	3.38%	2,775	-9.67%	2,093	-13.8%
1998	3,548	52.08%	4,436	-3.27%	3,622	30.52%	1,674	-20.0%
1999	3,467	-2.28%	4,220	-4.87%	1,959	-45.91%	2,727	62.9%
2000	2,931	-15.46%	3,818	-9.53%	3,179	62.28%	2,470	-9.4%
2001	3,191	8.87%	3,498	-8.38%	3,049	-4.09%	2,013	-18.5%
2002	2,909	-8.84%	2,982	-14.75%	2,485	-18.50%	2,026	0.6%
2003	2,339	-19.59%	3,138	5.23%	2,808	13.00%	2,164	6.8%
2004	2,376	1.58%	2,964	-5.54%	1,875	-33.23%	1,769	-18.3%
2005	1,700	-28.45%	2,276	-23.21%	3,255	73.60%	1,565	-11.5%
2006	1,237	-27.24%	1,423	-37.48%	2,918	-10.35%	1,108	-29.2%
2007	1,408	13.82%	1,268	-10.89%	1,462	-49.90%	1,041	-6.0%

Source: U.S. Census Bureau, Manufacturing and Construction Division

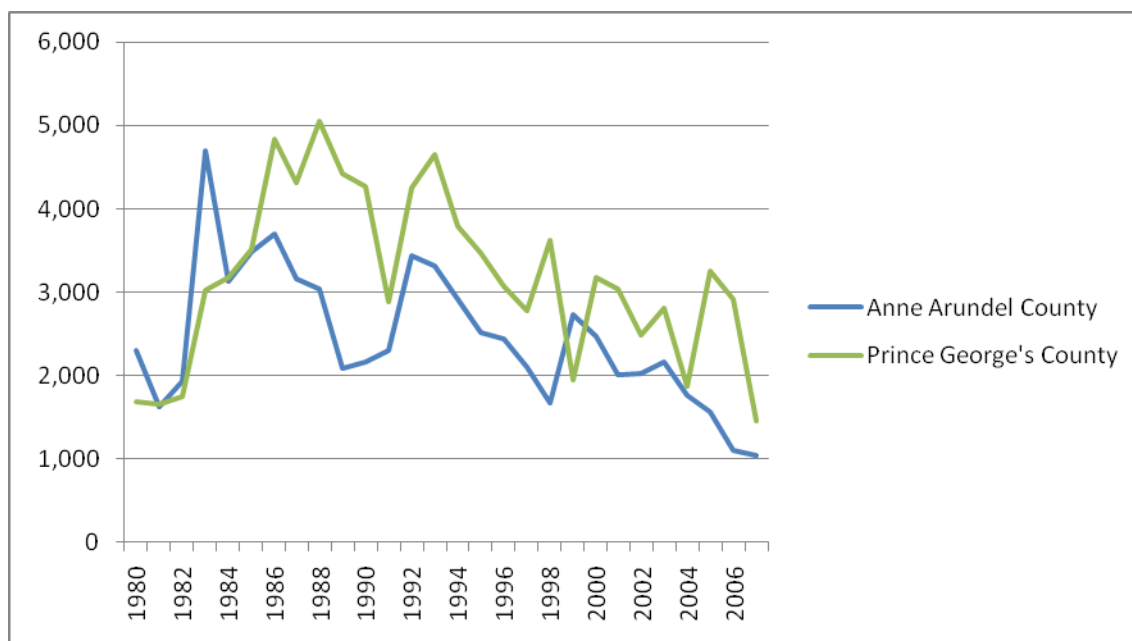
Figures 5 and 6 show permit activity in the counties paired for comparison.

Figure 5: Comparison of Single-Family Construction Permits Issued in Montgomery and Fairfax Counties from 1980 to 2007



Source: U.S. Census Bureau, Manufacturing and Construction Division

Figure 6: Comparison of Single-Family Construction Permits Issued in Anne Arundel & Prince George's Counties from 1980 to 2007



Source: U.S. Census Bureau, Manufacturing and Construction Division

Figures 7 and 8 show tabulations of the number of homes by year built and the percentage of single family attached (townhomes) by year, prepared from the 2007 American Community Survey (ACS) for the States of Maryland and Virginia and for the counties reviewed in this study. The ACS surveyed nearly 45,000 housing units in the Washington-Baltimore-Northern Virginia Combined Statistical Area, with a sampling rate of 1.34 percent.

The ACS data indicate that for single-family homes built in the 1980s, Montgomery County's attached share of single-family housing was very high, 48.1 percent. Unfortunately, the ACS questionnaire only asks whether the house was built for ranges of years, with 1980-1989 as the relevant category for that period, so no details are available for units built before and after November 1986, when the sprinkler requirements for townhouses went into effect in Montgomery County.

The percentage of attached single-family units in Montgomery County was higher during the 1990-1999 and 2000-2004 periods, when most single-family detached homes were not subject to sprinkler requirements, than during the period beginning 2005 when both attached and detached homes were required to have sprinklers. That pattern is the opposite of what would be expected if the sprinkler requirements discouraged townhouse construction during the period when most single-family detached homes did not have a sprinkler requirement.

In the 1990s, and again from 2000 to 2004, when Prince George's County was the only county with a requirement for sprinklers in all single-family detached homes, there was an increase in the County's share of single-family detached homes built in the region. The brackets of years used by the ACS do not easily delineate the three-year time period between 1989 and 1992 when sprinklers were required in townhouses but not detached homes. Because that coincided with a recession and a low rate of construction in all areas, the totals for the 1990s primarily reflect the period when sprinklers were required for all single-family homes (both attached and detached) built

in the county, but none of the other jurisdictions required sprinklers in detached homes (except some model homes).

Figure 7: Total Single-Family Detached Housing Units by Year Built

	Total Detached Housing Units	2005 or later	2000 to 2004	1990 to 1999	1980 to 1989	1970 to 1979	1960 to 1969	1950 to 1959	1940 to 1949	1939 or earlier
Maryland	1,197,504	34,826	99,443	164,222	171,009	166,586	167,367	170,117	80,006	143,928
Anne Arundel	126,129	3,324	7,863	18,771	21,440	18,757	19,301	19,927	8,273	8,473
Montgomery	184,409	2,916	10,445	19,711	30,135	23,997	31,699	33,803	14,954	16,749
Prince George's	164,521	4,846	12,890	16,907	21,555	21,629	37,341	25,449	13,446	10,458
Virginia	2,066,971	65,311	175,643	303,438	303,956	323,512	265,573	273,325	132,851	223,362
Arlington	30,923	183	644	749	1,600	1,053	2,634	7,880	8,445	7,735
Fairfax	203,632	3,739	11,619	23,073	44,668	38,313	35,507	35,776	6,707	4,230
Prince William	85,537	7,869	15,862	12,050	14,778	17,496	9,655	5,624	1,668	535

Source: 2007 American Community Survey

Figure 8: Attached Percentage of Single-Family Housing Units by Year

	Total Attached Housing Units	2005 or later	2000 to 2004	1990 to 1999	1980 to 1989	1970 to 1979	1960 to 1969	1950 to 1959	1940 to 1949	1939 or earlier
Maryland	29.5%	25.9%	26.8%	32.2%	35.7%	25.3%	13.6%	27.4%	29.2%	40.9%
Anne Arundel	23.1%	23.5%	39.9%	36.8%	25.7%	27.7%	7.5%	11.4%	10.4%	11.8%
Montgomery	26.47%	30.1%	33.5%	35.8%	48.1%	38.7%	9.8%	5.5%	1.1%	0.7%
Prince George's	22.6%	14.4%	20.9%	45.1%	40.1%	18.5%	7.8%	16.1%	9.0%	10.9%
Virginia	13.7%	22.6%	19.5%	18.2%	21.8%	16.0%	6.2%	4.6%	6.3%	5.2%
Arlington	25.3%	36.0%	18.3%	59.8%	62.8%	57.0%	18.2%	7.7%	27.5%	6.8%
Fairfax	31.3%	38.7%	40.9%	45.3%	39.6%	38.2%	14.0%	6.8%	18.2%	9.9%
Prince William	31.9%	34.0%	29.2%	45.0%	42.3%	23.2%	18.6%	15.7%	10.5%	0.0%

Source: 2007 American Community Survey

Unique information about the presence of sprinklers, as well as about attached and detached single-family housing is available from the U.S. Census Bureau's American Housing Survey (AHS), which collects detailed information about homes and their occupants. In addition to a national survey conducted every two years with a

sampling rate of about 1 in 2,000, the AHS conducts surveys of selected metropolitan areas on a rotating basis with higher sampling rates, as well as greater geographic detail. Fortunately, the AHS questionnaire was changed in 2007 to include a question about the presence of fire sprinklers, and both Washington and Baltimore were among the seven metropolitan areas surveyed that year.

As in all surveys, there are some inaccuracies due to random sampling error, as well as misreporting and other non-sampling errors. Even with the higher sampling rate used in the metropolitan area surveys, only about 2,700 homes are included in each area, resulting in a sampling rate of about 0.13 percent for the Washington Metropolitan Statistical Area (MSA) and about 0.25 percent for the Baltimore MSA. Because of this, it is hazardous to draw conclusions from sparsely-populated cell categories. With regard to the information on the year homes were built, moreover, the data generally reflects completion and occupation dates, rather than the date permitted or started, and may be incorrectly reported.

Figure 9 shows data from the National AHS. Except for mobile homes, the incidence of sprinklers is clearly higher for newer homes than for older ones. Multifamily units are more likely to have sprinklers than townhouses or other attached single-family units, which in turn are more likely to have sprinklers installed than detached single-family homes. The overall share of housing units for which sprinklers were installed was 4.3 percent, with townhouses having 5.8 percent, but among single-family detached homes the share with sprinklers was only 1.5 percent.

Figure 9: National Totals and Percentage with Sprinklers Installed by Type of Housing

	All Types		Single Family Detached		Single Family Attached		Multifamily		Mobile Homes	
Year Built	Units	Sprinklers	Units	Sprinklers	Units	Sprinklers	Units	Sprinklers	Units	Sprinklers
2004-2007	6,565,446	13.5%	4,559,926	5.2%	652,625	19.2%	965,589	54.4%	387,306	0.0%
2000-2003	7,451,843	12.5%	4,815,523	3.5%	538,207	19.1%	1,318,459	49.2%	779,654	1.1%
1995-1999	8,784,020	8.7%	5,187,160	3.0%	489,732	11.0%	1,439,392	37.1%	1,667,735	1.2%
1990-1994	7,011,075	6.2%	4,378,513	1.9%	457,045	8.2%	1,093,528	28.4%	1,081,990	0.3%
1980-1989	16,269,327	5.2%	8,182,271	1.9%	1,355,164	3.8%	4,903,128	12.5%	1,828,764	1.3%
1970-1979	25,349,724	2.9%	13,509,634	0.9%	1,281,923	1.1%	8,442,834	7.2%	2,115,333	0.3%
1950-1969	28,244,469	1.5%	20,777,625	0.8%	784,084	1.6%	5,981,472	4.3%	701,288	0.5%
1949 or earlier	28,336,156	1.6%	18,879,153	0.8%	1,568,590	1.0%	7,775,986	3.6%	112,428	0.0%
All Years	128,012,060	4.3%	80,289,805	1.5%	7,127,370	5.8%	31,920,388	11.8%	8,674,498	0.8%

Source: 2007 American Housing Survey - Tabulated by Newport Partners from AHS microdata.

When comparing the Washington MSA (shown in Figure 10) to national numbers for all years (Figure 9), it is clear that the Washington MSA has a higher incidence of sprinklers than the rest of the Nation, with 11.9 percent of all homes having sprinklers, including 13.7 percent of the townhouses and 5.1 percent of the detached single-family homes, as shown in Figure 10. The Baltimore MSA also had a higher overall incidence of sprinkler installation than the Nation, although the share among detached homes with sprinklers, at 1.7 percent, was only slightly above the national average of 1.5%.

Figure 10: Percentage of Total Housing Units with Residential Sprinklers for Selected Areas as of 2007

	Single-Family Detached Homes	Single-Family Attached Homes	All Structure Types
Washington MSA	5.1%	13.7%	11.9%
-Montgomery County, MD	5.4%	25.8%	15.7%
-Prince George's County, MD	16.1%	38.4%	16.6%
-Fairfax County, VA	1.3%	4.9%	7.8%
Baltimore MSA	1.7%	12.6%	9.1%
-Anne Arundel & Queen Anne's Counties, MD	2.1%	32.0%	11.2%

Source: 2007 American Housing Survey National and Metropolitan Area Data

Although the AHS data shown in Figure 11 indicates that some homes in Montgomery and Prince George's Counties were built without sprinklers after such requirements went into effect (probably because the year built was misreported), the effects of the requirements are obvious from the data. It is also noteworthy that the percentage of homes with sprinklers in the Washington, DC suburban counties is also above the national average before sprinklers were required. Perhaps that was due to retrofits encouraged by the requirements for sprinklers in new homes, or to the property tax credit offered by Montgomery County for retrofitting sprinklers beginning in 2000.

Alternatively, the sprinklers could have been included when those houses were originally built, rather than added later.

Figure 11: Percentage of Housing Units with Sprinklers by Year Constructed

	Single-Family Detached Homes					Single-Family Attached Homes				
	Before 1970	1970-1989	1990-1999	2000-2007	Total	Before 1970	1970-1989	1990-1999	2000-2007	Total
National Averages	0.8%	1.3%	2.5%	4.5%	1.5%	1.2%	2.5%	9.6%	20.9%	5.8%
Washington MSA	1.3%	1.9%	10.1%	20.4%	5.1%	2.7%	5.7%	30.6%	35.9%	13.7%
-Montgomery County, MD	1.3%	2.0%	14.5%	44.4%	5.4%	10.8%	9.2%	63.0%	80.0%	25.8%
-Prince George's County, MD	1.0%	9.4%	51.0%	100.0%	16.1%	12.9%	21.9%	75.4%	100.0%	38.4%
-Fairfax County, VA	2.2%	0.0%	0.0%	5.0%	1.3%	0.0%	0.0%	6.6%	28.6%	4.9%
Baltimore MSA	0.6%	0.6%	2.9%	11.3%	1.7%	0.0%	5.1%	52.3%	81.9%	12.6%
-Anne Arundel & Queen Anne's Counties, MD	0.0%	1.0%	7.0%	13.1%	2.1%	0.0%	0.0%	66.2%	88.0%	32.0%

Source: 2007 American Housing Survey National and Metropolitan Area Data

The AHS data do not answer the question about whether sprinkler requirements affected the volume, price, or character of new construction, but they do show the greater role of townhouse construction in Montgomery and Prince George's Counties and in the surrounding area than is typical in other parts of the U.S., as well as providing unique information about the overall occurrence of sprinkler systems.

VI. Construction Industry and Regulatory Analysis

Interviews were conducted with builders and with the staff of the Maryland-National Capital Building Industry Association (MNCBIA) to determine whether the sprinkler requirements created any impacts that were not reflected in the data for construction permits and the other statistics discussed above. All of those interviewed indicated that there were not any significant effects on the volume, character or price of

new construction. They also suggested that any consequences of the sprinkler requirements were overwhelmed by other more significant regulatory and cost factors, which are discussed below.

In Prince George's County, those additional factors included the introduction of public safety and school impact fees that currently amount to over \$20,000 per house, and regulations requiring more expensive exterior materials, landscaping, and setbacks. In Montgomery County, the expansion of the Moderately-Priced Dwelling Unit requirement, mandating that a share of the homes in each subdivision be sold at reduced prices to moderate-income households, was cited a major cost factor. In addition, impact fees in Montgomery County were increased from about \$4,000 per unit to about \$36,000 during this period. A list of the major changes is provided in the Appendix B.

To further analyze the sprinkler regulation chronology and the other influences, the authors scanned and digitized the legislative and regulatory newsletters prepared by MNCBIA from 1989 to 2008. Reviews and searches of those documents showed the extent and diversity of changes in regulations and fees. It was notable, moreover, that most references to sprinklers in those newsletters concerned efforts by MNCBIA in cooperation with local officials to provide education and technical support during implementation of the requirements. This may have been a factor in the lack of disruption caused by the sprinkler requirements.

The **Maryland-National Capital Building Industry Association** (MNCBIA) is a regional organization of more than 700 member firms representing the interests of more than 18,000 individuals in the building and development industry operating in Calvert, Charles, Montgomery, Prince George's and St. Mary's counties in Maryland and in the city of Washington DC.

VII. Conclusion

The analysis of construction permit and survey data, interviews with builders, building industry trade groups, and local officials consistently indicated an absence of

adverse impacts on housing supply and costs from the implementation of residential sprinkler requirements. Indeed, the data generally suggest that there were increases in housing supply that coincided with the times that requirements became effective, although that probably reflects the broader finding from this analysis—that sprinkler requirements were insignificant alongside much stronger influences, including other regulations and fees, growth in jobs and population, and the cost and availability of land, financing, materials, and labor.

Although the purpose of the study was to determine whether there were effects from sprinkler requirements rather than to determine the best way to implement requirements, the research suggested several factors that helped to smooth the process, and which other jurisdictions may want to consider. Despite resistance to sprinkler requirements from the home building industry, once the requirements were adopted by the local government, with a period of time before the requirements went into effect, the industry association and local officials worked together to provide information and education to the builders and subcontractors.

Appendix A - Communities Considered for the Comparative Analysis of Housing Cost and Supply Impacts of Sprinkler

City	State
Ketchikan	AK
Chandler	AZ
Fountain Hills	AZ
Peoria	AZ
Scottsdale	AZ
Tucson	AZ
Alhambra	CA
Anaheim	CA
Aptos	CA
Arcadia	CA
Auburn	CA
Bakersfield	CA
Beverly Hills	CA
Brownsville	CA
Burbank	CA
Cambria	CA
Carmel	CA
Carpinteria	CA
Castroville	CA
Cloverdale	CA
Corte Madera	CA
Culver City	CA
Daly City	CA
El Cerrito	CA
El Monte	CA
Foster City	CA
Fresno	CA
Gilroy	CA
Glendale	CA
Hayward	CA
Healdsburg	CA
Hemet	CA
Kentfield	CA

La Habra Heights	CA
Lakeside	CA
Larkspur	CA
Livermore	CA
Loma Linda	CA
Mill Valley	CA
Millbrae	CA
Milpitas	CA
Montclair	CA
Montebello	CA
Monterey	CA
Napa	CA
Newark	CA
Norco	CA
Novato	CA
Oxnard	CA
Pacific Grove	CA
Palm Springs	CA
Petaluma	CA
Phelan	CA
Pismo Beach	CA
Rancho Cucamonga	CA
Rancho Santa Fe	CA
Redlands	CA
Redondo Beach	CA
Rialto	CA
Richmond	CA
Riverside	CA
Salinas	CA
San Bernardino	CA
San Gabriel	CA
San Luis Obispo	CA
San Rafael	CA
Santa Cruz	CA

Santa Monica	CA
Santee	CA
Saratoga	CA
Sausalito	CA
Sonoma	CA
Spring Valley	CA
Sunnyvale	CA
Tahoe City	CA
Tiburon	CA
Union City	CA
Vacaville	CA
Vallejo	CA
Ventura	CA
West Covina	CA
Woodacre	CA
Woodland	CA
Woodside	CA
Aspen	CO
Brighton	CO
Carbondale	CO
Fruita	CO
Boca Raton	FL
Casselberry	FL
Flagler Beach	FL
Jacksonville Beach	FL
Longboat Key	FL
Marianna	FL
Orlando	FL
Oviedo	FL
Palm Beach	FL
Tampa	FL
Honolulu	HI
Iowa City,	IA
Ketchum	ID
Barrington	IL
Bedford Park	IL
Berkeley	IL
Bridgeview	IL
Clarendon Hills	IL

Des Plaines	IL
Flossmoor	IL
Glen Ellyn	IL
Glenwood	IL
Hoffman Estates	IL
Huntley	IL
Justice	IL
LaGrange Park	IL
Libertyville	IL
Lincolnwood	IL
Long Grove	IL
Matteson	IL
Mount Prospect	IL
Mundelein	IL
Oak Forest	IL
Oakbrook Terrace	IL
Palos Hills	IL
Park Ridge	IL
River Forest	IL
Round Lake	IL
Skokie	IL
St. Charles	IL
Streamwood	IL
Vernon Hills	IL
Villa Park	IL
West Dundee	IL
Wheeling	IL
Leawood	KS
Aberdeen	MD
Emmitsburg	MD
Frederick	MD
Gaithersburg	MD
Havre de Grace	MD
Laurel	MD
Mt. Airy	MD
Pikesville	MD
Rockville	MD
Salisbury	MD
Upper Marlboro	MD

Westminster	MD
Berwick	ME
Orono	ME
Plymouth	MN
Barnhart	MO
Camdenton	MO
Raymore	MO
Sunrise Beach	MO
Billings	MT
Wrightsville Beach	NC
Brookline	NH
Laconia	NH
Lebanon	NH
Newark	NY
Poughkeepsie	NY
White Plains	NY
Florence	OR
Broomall	PA
Buckingham	PA
Canonsburg	PA
Carrol Valley	PA
Conshohocken	PA
Exton	PA
Jamison	PA
Phoenixville	PA
Pottstown,	PA
Upper Valley Township	PA

Warrington	PA
Wrightstown	PA
York	PA
Mt Pleasant	SC
Ashland City	TN
Cheatham County	TN
Collierville	TN
Nolensville	TN
Pleasant View	TN
Addison	TX
Carrollton	TX
Coppell	TX
Houston	TX
Houston	TX
Park City	UT
Provo	UT
Prince George	VA
Montpelier	VT
Auburn	WA
Dupont	WA
Issaquah	WA
Olympia	WA
Port Angeles	WA
Redmond	WA
Seattle	WA
Woodinville	WA

Appendix B - Major Ordinances Impacting Housing Construction in Comparison Counties

1989 – May 2009

This list was developed by reviewing Maryland-National Capital Building Industry Association's monthly Regulatory Report. Special thanks goes to the MNCBIA staff for providing access to hard copies of reports not yet available online.

STATE OF MARYLAND ISSUES

1991: Forestation regulations enacted have had a big impact and in 1993 the Maryland Builders Association was trying to repeal these legislations. No quantifiable data was given on the impact, but it was a major issue.

1997: The state passed a series of smart growth bills, including the Rural Legacy Program in an effort to preserve 15,000 acres. Other bills created priority spending areas and density requirements.

May 2001: Governor Glendening announced he will invoke a 1974 state law to intercede in local planning issues to stop or reduce sprawl. He subsequently used this effort to stall big developments across the state.

MONTGOMERY ISSUES

November 1997: Passed Bill 34-97 "pay and go" and reduced fee payment to 10% at time of subdivision approval and 90% at building permit to limit the upfront or carrying costs a builder has. Other pro-building changes were included in this bill. Law sunsets in four years.

Note: Amended to exclude residential units early 1998 on the belief it caused too much growth.

Note: Set fees for residential impact fees to come into effect early February 1998 (see table below).

Moratoria	Impact Fee
Single Family Detached	\$4,500
Single Family Attached	\$3,500
Multifamily	\$2,500
Non Moratoria (Avoids local area review)	
Single Family Detached	\$3,000
Single Family Attached	\$2,250
Multifamily	\$1,500

April 1999: Increased impact fees in Germantown and Eastern Montgomery

Early 2000: MOU applicants are now required to post a bond and fee for improvements that were once granted by WSSC at no charged.

September 2000: A one-time property tax credit against general county tax for installing fire sprinklers in any detached single-family dwelling unit and any attached dwelling unit, or multi-family building that didn't require them by law.

2001: The state created the Office of Smart Growth to promote and coordinate smart growth developments over sprawl.

2001: Clarksburg in Montgomery County changed impact fee to \$2,752 for single family, \$1,981 multi-family and \$573 for multi-family senior housing. Bill No 4-01.

January 2002: Gaithersburg voted for moratorium on building for a year while city develops a comprehensive master plan. A few big subdivision projects were caught in the moratorium.

March 2002: Passed Bill 47-01 for a new impact tax of \$2,100 for single-family, \$1,100 for multi-family, and \$325 senior multi-family, incentives granted for affordable developments. Tax was phased in over 18 months.

October 2002: Effective September 24, all new homes, issued a building permit on or after September 24, in Rockville will need fire sprinklers.

February 2003: Montgomery County's permitting offices have seen increases in permitting and building activity leading to an increase in processing time.

February 2003: Gaithersburg requires sprinklers in new single-family homes. Proximity of homes to other homes was a leading concern for the ordinance.

October 2003: Montgomery County passes an ordinance requiring all new residential construction to have sprinkler systems, starting Jan 1, 2004.

November 2003: Effective March 01, 2004, the highest impact in the state will go in effect in Montgomery, MD. The tax has a minimum of \$13,500 for single-family detached in most areas and in Clarksburg a minimum of \$16,250 was set. Also included was a square footage excise tax of a \$1 per square foot for homes over 4,500 square feet. The capacity of the home's school system could also add additional fees, up to \$12,500 if the school district is over 105% capacity.

March 2004: A Transportation Impact Tax for single-family detached is set at \$5,500 in county and \$8,250 in Clarksburg. Along with a School Facility Tax for single-family detached is set at \$8,000 and multi-family is set at \$1,600.

July 2004: Since 2003, TRDS have increased from \$9,000 to \$35,000 in the County. This is believed to be due to the inability to meet demand for TDRs in Clarksburg. County might release some of the 1,800+ TDRs they have.

September 2005: Town of Chevy Chase enacted a 6-month moratorium August 10, with some exceptions for additions and remodels but none for new homes.

October 2005: A long discussion over building heights has been going on. 197 building permits applications were put on hold during this many-month debate. Issues include terrace and porch heights among other things.

Note: November 2005 reports and additional 150 permits are in limbo as well, because of this purported incorrect interpretation of height restrictions.

February 2006: Review times and the issuance of building permits have slowed to a trickle with some permit applications in process for more than 90 days. General short-staffing have lead to backlogs for developments since mid-2005.

March 2006: Increased building inspection fees by 25% to \$1,100 minimum, effective March 1. Additional reviews and the still-to-be-approved final Use & Occupancy permit requirement can tack on an additional \$1,000.

March 2006: P&P will go to a 100% fee-driven funding strategy. In April P&P projected a 700% increase in fees, so they went back to drawing board.

Effective April 27 – New fees are set, department used to receive \$1.39 million in fees now set to get over \$4 million in fees.

August 2006: Set December 1, 2006 as the effective date for subdivisions in metro station zones over 40 units to set aside 10% of the dwellings for 80-120% area median income, workforce housing units.

November 2006: Approved 2003 edition of the NFPA and Life Safety Code 101, with a carbon monoxide detector amendment.

December 2006: New well and septic requirements are enacted to meet adequate water supply for fire demands, based on NFPA 1 2003 (18.3.1 and 18.3.2).

December 2007: New school capacity thresholds set for January 2008. The increase was around 70% to 125% depending on location and building type. Additionally, the large home excise tax was increased from a \$1 square foot to \$2 per square foot over for homes over 4,500 square feet.

PRINCE GEORGE ISSUES

Jan 1, 1992: All new single family residential construction must be sprinkled.

July 1995: School Facilities Surcharge set at \$1,500 for new SFD and \$800 on townhomes, and \$400 multifamily units, effect July 1, 1996.

Mid 1997: Increased school surcharge from \$1,500 to \$2,500 for single-family, \$800 to \$1,200 for townhomes, and \$400 to \$700 for multifamily. No grandfather clause on increase.

1997: Passed CB-3 which limited building in areas where school system is over capacity.

Note: This issue was raised for many years with the over capacity percentage fluctuating from 95% to 115% of capacity.

June 1999: Passed CB-15 which had many components; including adjusting the school capacity formula resulting in 33 schools becoming over-crowded (used to be 12) and reducing time limits for construction to begin on grandfathered developments.

July 2000: Increased school fee from \$2,500 to \$5,000.

Fall 2001: Passed CB-40-2001, which limits building in schools overcapacity, mostly impacts large develops.

July 2003: Increased school impact fee from \$5,000 to \$12,000 (or \$7,000) depending on location of development.

December 2004: CB-89 adjusted APF requirements, leading to a fear that the amount of area available for development will be reduced.

February 2005: CB-89 stops 16 construction projects, for failing to pass response times for police and rescue.

July 2005: Added a \$2,000 public safety surcharge to homes in Developed Tier and \$6,000 to homes in the Developing and Rural Tiers for building permits on or after July 1, 2005.

July 2005: Adjusted the CB-89 fire/EMS/police time requirements to open up development.

July 2005 – CR-45-2005 increased the school tax to \$7,412 if in developed Tier and \$12,706 if outside developed tier in county.

August 2005: No new building permits may be issued in Clarksburg Town Center development unit all a review of site plans is done.

December 2005: Set mitigating fees for developments outside the response times, in response to CB-89. Fees are \$3,780 if dwelling is outside police response time and \$1,320 if outside fire response time. If both dwelling fails the response time tests for both police and fire the fee is \$5,100.

July 2006: Set the School Facilities Surcharge at \$13,151 for buildings in Developing and Rural Tiers and \$7,671 for Developed Tier. The Public Safety Surcharge is \$6,210 in the Developing and Rural Tiers and \$2,070 in the Developed Tier.

August 2007: Increased the School Facilities Surcharge to \$13,493 in the Developing and Rural Tiers and \$7,870 for Developed Tier. The Public Safety Surcharge increased to \$6,371 in the Developing and Rural Tiers and \$2,124 in the Developed Tier.

October 2008: Base fees for four plan applications (pre-application, preliminary plan, project plan, site plan) were increased by \$1,000 and record plat fees increased from \$1,835 to \$2,200.

WASHINGTON, DC

June 2005: Single-family dwelling require fire sprinklers, code was based on Montgomery County's ordinance.