ZONING VARIANCE ADMINISTRATION IN PRACTICE:
INFLUENCING FACTORS AND TRENDS

By

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To my parents and my future family

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LIST OF ABBREVIATIONS

ANCs	Advisory Neighborhood Commissions
BZA	Board of Zoning Adjustment
DCRA	Department of Consumer & Regulatory Affairs
FHA	Fair Housing Act
NCPC	National Capital Park and Planning Commission
OP	Office of Planning
OZ	Office of Zoning
PUD	Planning Unit Development
SSL	Square, Suffix, Lot
SSZEA	Standard State Zoning Enabling Act
ZC	Zoning Commission
ZEA	Zoning Enabling Act

Abstract of Dissertation Presented to the Graduate School
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Over time, local governments have long sought ways to integrate flexibility within

the zoning process. The zoning variance represents one of these tools. However, this

tool is perceived as less than precise because vague legal standards for issuing

variances, undue hardship, or practical difficulties allow local decision-making bodies to

exercise significant discretion.

The author conducted a substantial review on zoning variance which covered

definition of zoning variance, types of variance, conditions to grant variance,

administrative body and criticism of zoning variance; through careful examination of

these issues, we seek to answer the following questions: According to the literature,

which factors affect the decision making of zoning administrative bodies? Moreover,

how were these factors determined, and to what extent do they affect the final decision?

Are these decisions related to the economic and social characteristics of communities?

What are the spatial distributions of variance applications and decisions and how do

these distributions reflect the correlation between the decisions and economic and

social characters? How are the decisions of variances represented in the time

dimension? Are the decisions consistent through time? The purpose of this study was to understand those factors which influence the decisions of administrative boards in the approval or denial of variances.

Four hypotheses in the literature about the decision-making of administrative bodies were proposed by the author. The first of these is: Hypothesis 1: granting of variance applications is significantly higher than denial. This is a general view about the Board of Zoning Adjustment (BZA)'s decision. The other three hypotheses deal with the factors which might affect the BZA's decision. Hypothesis 2: opponents from affected neighborhoods influence the zoning administrative board's decision making; Hypothesis 3: type of variance application affects the BZA's decision making; Hypothesis 4: the zoning administrative board does not place significant weight on suggestions from other public agencies in its decision making.

To assist in answering these research questions and testing the four hypotheses statistically, a case study was conducted. The author collected and compiled 2,140 variance decisions made by the Board of Zoning Adjustment in Washington D.C. from 1980 to 2009. The first hypothesis was tested by Binomial Test. Further, a simplified binary response model was developed to test the other three hypotheses and examine to what degree those factors affect the BZA's decision. Then the model considered additional variables that might affect the BZA decisions.

According to the results of statistical tests and the binary response model, the author came to the conclusion that opponents from affected neighborhoods, type of variance, and suggestions from Office of Planning and Advisory Neighborhood Commissions did affect the BZA's decisions significantly. Except for the Office of

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Planning (OP) and the Advisory Neighborhood Commissions (ANCs) suggestions, other public agency inputs were not given significant weight by the BZA in Washington D.C. It was also found that land value influenced in the BZA decisions. The higher the land value, the lower the probability that the BZA would deny the application.

In order to test a cluster of variance applications and decisions, the author applied Hot Spot analysis in ArcGIS to demonstrate the regions where variance applications and decisions were highly concentrated. The maps revealed that clusters of variance applications and decisions did exist in Washington D.C.

CHAPTER 1
INTRODUCTION

Statement of Problem and Research Questions

As a tool of land use regulations in the United States, zoning plays an important role in protecting the defining characteristics of local communities, as well as promoting local public welfare and economic development. Under zoning ordinances, the land is divided into different districts in which the dimensional characteristics of the lot, the use of the lot, and the buildings on the lot are regulated and specified by different criteria. Since zoning ordinances cannot describe all situations encountered in complicated land use, strict observation of zoning ordinances might bring unfairness or hardship to individual properties.

As a "safety valve" (Burke & Snoe, 2004; Cohen, 1995; Reynolds, 1999; Shapiro, 1969), the zoning variance provides flexibility, allowing land use not expressly permitted by zoning ordinances under some circumstances. State or municipal legislative bodies authorize local administrative bodies (usually called the "Board of Zoning Adjustment"[1]) to grant or deny applicants' requests. However, zoning variance is a controversial topic in the field of law due to the discrepancies between its theory and practice. In the three key tests commonly applied by many legislative bodies to decide whether to grant or deny an application, their ambiguous expression leaves administrative bodies more flexibility in final decision making. The boards make decisions at their discretion about whether the application is contrary to public welfare; whether it is substantially

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[1] The name and structure of administrative bodies are different in different areas. Usually it is called Board of Zoning Adjustment or Board of Zoning Appeals. In New York City, it is called Board of Standards and Appeals. Since Washington, D.C. is a case study in this paper, Board of Zoning Adjustment (BZA) would be used in this paper to represent all the administrative bodies. Since it is not the primary focus of this paper, detailed information about this administrative body are not covered here. For more information, refer to Land Use Law by Salkin.

incompatible with the comprehensive plan; and, whether the applicant would meet "undue/unnecessary hardship" or "practical difficulties" if he or she strictly abides by zoning ordinance.

Some scholars have noted that zoning administrative boards are too lenient with zoning variance applicants, making the approval rate very high ("Building Size, Shape," 1951; Reynolds, 1999). Protestors from neighborhoods tend to urge the board to deny variance applications (Leary, 1958). Since use variances are considered more problematic for the purposes of zoning ordinance than area variances, boards are more reluctant to grant use variances (Burke & Snoe, 2004). While the law encourages administrative boards to follow the advice of planning experts, Shapiro (1969) suggests that "the advice of planners seems to have little effect on" these boards (p.11).

The research objective of this study was to examine the factors affecting zoning administrative bodies' final decision making on variance applications, as well as identify trends of variance applications and determinations from the time dimension perspective. Based on existing literature, the possible factors will be identified and tested to achieve a thorough understanding of their respective influences.

The research questions to be addressed in the study are:

RQ 1. According to the literature, what factors affect decision making of zoning administrative bodies? Do these previously identified factors affect the board's decision significantly? Which factors diverge from the criteria for granting a zoning variance?

• Is the approval rate of zoning variance applications significantly higher than the denial rate?

• Do the opponents of the variance application from the neighborhood affected influence the board's decision?

• Dose the type of variance really affect the BZA's decision?

• Do the boards weight highly recommendations from other public agencies?

RQ 2. Are the decisions related to the economic and social characteristics of communities? Does clustering occur with respect to both zoning variance applications and approvals? How do these clusters reflect the correlation between the decisions and the economic and social characters?

RQ 3. Is there a method we can apply to verify the identified factors' influence in different jurisdictions? What are the limitations?

Research Outline

My literature review on zoning and zoning variance is conducted to better understand the background, research questions, and research purpose. The origin, purpose, function, and practice of zoning are reviewed. Comments on zoning theory and practice are also listed. A detailed review of zoning variance is conducted, which includes definitions of variance type, conditions for granting variance, administrative bodies related to variance, and relevant criticism.

Based on the literature, four hypotheses are proposed to examine the first research question. These four hypotheses are as follows:

Hypothesis 1 Granting of variance applications is significantly higher than denial.

Hypothesis 2 Opponents from affected neighborhoods influence the zoning administrative board's decision making.

Hypothesis 3 Type of variance application affects the BZA's decision making.

Hypothesis 4 The zoning administrative board does not place significant weight on suggestions from other public agencies in its decision making.

Two binary response models are developed based on the literature and the hypotheses. The initial model is a basic one that includes only those variables that need to be tested in the hypotheses. The dependent variable is probability of granting the variances; the independent variables are opponents, suggestions from other public agencies, and type of variance. An improved model will include more variables that could potentially affect final decisions. In addition to the variables in the initial model, the improved model will include property area, land value, existing type of property, and type of variance applicant.

Washington, D.C. is the case study area. It was one of the first cities to develop a comprehensive zoning ordinance, which occurred as early as the1920s. In 1958, it adopted a new set of zoning regulations. Washington, D.C's model emphasizes inter-organization cooperation and community communication. The Office of Planning plays an important role in the application of zoning variances. It is also plays an important role in the public review of new zoning regulations. Additionally, the Office of Zoning provides online public access to variance cases back to 1960s, as well as the latest cases, which supplies reliable first hand data for my research.

Based on more than two thousand variance cases from 1980 through 2009, this study aims to summarize the critical information of each case and compile this data for quantitative analysis. In addition, GIS is used to show the spatial distribution of variance applications and decisions, which provides a visual and direct exhibition on the

geographic characters of variance. This is also a good way to display the cluster effect

of variance.

CHAPTER 2
LITERATURE REVIEW

Background of Zoning

People desire homes in pleasant neighborhoods with convenient schools
and shopping centers, prosperous communities with space for economic
activities that offer sufficient and diverse opportunities for employment, a
variety of recreation facilities, patterns of urban development that will
inspire community pride and participation in cultural and civic affairs,
efficient and safe transportation, and many other factors required of our
physical environment for living a full life. In a rapidly growing urban area
these physical characteristics can be achieved and maintained if there is
sufficient forethought and planning, and if plans are carried out.[1]

— *County of Alameda Master Plan 3 (1957)*

It has been more than ninety years since the nation's first comprehensive zoning

ordinance. The Standard State Zoning Enabling Act (SSZEA) was adopted in New York

City in 1916 (Gardner, 2004). Zoning is a tool of land-use regulation that is designed to

protect and promote public health, safety and the welfare of the community, as well as

to maintain economic stability and aesthetics (Schmutz, 1931). By regulating the uses[2]

of lots and the characteristics of buildings on the lots, zoning regulations, which differ in

different districts (Bassett, 1922), are intended to ensure "an orderly physical

development of the city, borough, township or other community."[3] Put simply (although

somewhat abstractly), they ensure "a place for everything and everything in its place"

(Perin, 1977) in order to "make the city an orderly and better place" (Steele, 1986).

From the perspective of economics, zoning "tends to raise the general standard of living

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[1] The epigraph to this chapter is drawn from (Donovan, 1962, p. 102), originally from County of Alameda
Master Plan 3.
[2] The term "use" in zoning ordinance means "the purpose for which the building is designed, arranged or
intended, or for which it is occupied or maintained" (Gardner, 2004, p. 434).
[3] (Psota, 2005, p. 537), citing Hanna v. Bd. of Adjustment, 183 A.2d 539, 543 (Pa. 1962).

through maximizing the total net product even though it may be disadvantageous to some individuals in each particular instance" (Bailey, 1959, p. 289). If use land value to represent the net project, "a social optimum is attained when each local authority imposes zoning regulations so as to maximize the land value in its jurisdiction" (Helpman & Pines, 1977, p. 983).

The conception and essence of zoning's goals and functions change as professionals' comprehension of land-use development and strategy improve. It also responds to changes in social, economic, and political contexts. "Contemporary zoning ordinances bear scant resemblance to those used in the first fifty years of zoning practice" (Owens, 2004, p. 302). Zoning originated from concerns about potential nuisance from the laundry services that were developing around residential neighborhoods (Groves & Helland, 2002), which led to regulation of types of land use (residential, commercial, and industrial). In the first years when zoning appeared, it was not popular as it put strict restrictions on the use of private properties. But "modern crowding" has "brought about recognition of the wisdom of having certain districts devoted exclusively to residential, commercial, and industrial uses" (Dukeminier, 2002). In addition, it became popular among homeowners and developers who were concerned about the loss of residential properties' value. Fischel (2004) noticed that zoning was originally been proposed by homebuilding developers, however, home-owners became a major force in local politics. The purpose was to protect residential properties from decreasing values caused by surrounding industrial and high density residential uses as the improvement of infrastructure and public transportation around 1910-1920 (Fischel, 2004), and to keep the housing market stable and housing prices

predictable. Aside from developers and homeowners, social reformers and planners were also proponents of zoning regulations. Social reformers focused on the improved living environment resulting from zoning, while planners were more able to maximize efficiency by orderly assigning functions in each district (Gardner, 2004).

The primary purpose of zoning was to protect residential communities from being interrupted by "the congestion, noise, traffic, pollution, and general ugliness associated with commerce and industry" (Shlay & Rossi, 1981, p. 705), especially for single family residential communities. Working in concert with this goal were other more detailed and comprehensive concerns regarding certain aspects of public services, such as light, space, and traffic, etc. These concerns led to the "bulk" function of zoning, which is to regulate buildings and the relationship between a lot and the building on it, such as height, number of stories, side yard, rear yard, front yard, lot area, lot occupancy, and floor area ratio, etc. The bulk function is used for three goals: "control over density of population in living and working areas, adequate daylighting of buildings, and sufficient open space around buildings for rest and recreation" ("Building Size, Shape," 1951, p. 507). Shlay & Rossi (1981) placed considerable weight on the protective function of zoning. It protects residential neighborhoods, protects property value, and protects the public's welfare. Zoning ordinance is also seen as an effective way to prevent free riders[4] in housing market, which helps "guarantee that home values yield property tax revenues sufficient to cover the cost of supplying services" ("Zoning for the," 1980, p. 752).

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[4] "Free rider" is widely used in economics and political science, which means the person who consumes public resources without paying the fair share of his/her using. For example, in the housing market, a free rider could be the property owner who builds a high density dwelling in a low-density community, which consumes more public services without paying the corresponding costs.

The views about the protective function of zoning are relatively traditional and conservative. Steele (1986) summarized two different modes of zoning regulations based on different goals: one is to conserve urban communities, which refers to zoning's protective function mentioned above; the other is to use economic rationality to develop land use. Some scholars put high value on the proactive developing function of zoning, which helps to promote local economic development and enhance the "economic stability of home ownership" (Dennis, 2000, p. 271). Since "zoning can affect the price of housing by shifting either supply or demand or both" (Pogodzinski & Sass, 1990, p. 295), local government can use zoning as a tool to compensate for the deficiency caused by the housing market and to stabilize the local economy, as well as to correct "failures in the housing and public service markets" ("Zoning for the," 1980, p. 748). Particularly for commercial and industrial districts, zoning helps to internalize external costs, especially the environmental cost. The economies of agglomeration[5] help further development of local business and economy. When an existing district encounters structural problems and the type of use may no longer be suitable for redevelopment, rezoning[6] is a useful way to help address and curb further problems. It is shown that "a residential-to-commercial rezoning often is viewed as a measure of increasing employment opportunities for local residents" (Heffley & Hewitt, 1988, p. 373). The protective function and the proactive developing function of zoning "represent inconsistent abstract approaches and often come into conflict. What is needed is some balance between them" (Steele, 1986, p. 711).

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[5] The "economies of agglomeration" means companies benefit from and decrease costs by locating near each other, especially for the companies in related industries.
[6] For information about "rezoning", see "Zoning Variance and Rezoning" in Chapter 2.

The Standard State Zoning Enabling Act (SSZEA) adopted by New York City in 1916 was already surprisingly complete, and was divided into three functions: control the height of buildings, control the dimension of properties, and protect functional districts divided by uses. However, the contents were conservative because this act should be granted by the highest courts of the state and nation (Swan, 1949). Within nine years, 368 municipalities had adopted their own zoning ordinances (Gardner, 2004). The justification of zoning's constitutionality was first explored in the case Euclid v. Ambler, in which the U.S. Supreme Court upheld zoning plans in the village of Euclid, which were previously rejected by local courts (Gardner, 2004). In the same year, the Zoning Enabling Act (ZEA) was enacted by U.S. Department of Commerce as a model to encourage states to enact their own legislation similar to ZEA ("Seeking a Variance," 2000).

Since the implementation of zoning, criticism from some lawyers, urban planners, and others has seemed ceaseless. Zoning is criticized as "being irrational, arbitrary, and venal in operation" (Steele, 1986, p. 712). Fichel (1978) commented that zoning was an erosion of private property rights. That is, the rights to determine the use of property and the dimensional characteristics are transferred from the property owner to local zoning authorities. However, the existence of zoning becomes a potential bed of corruption that could create "wealthy zoning officials and land speculators" (Benjaminson & Anderson, 1990, p. 68). "Zoning is the single biggest corrupter of the nation's local governments" (p.68), said Dan Paul, a Miami attorney. Additionally, since "all zoning restrictions have some exclusionary effects[7]" (Mandelker, Payne, Salsich, &

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[7] Exclusionary zoning refers to "a zoning ordinance that excludes based on economic status" (Durkin, 2006, p. 445). Aside from economic status, which might exclude some groups from living in certain

Stroud, 2005), they can lead to inequities and indirect racial and income discrimination.

Some examples are zoning regulations on density, minimum building size, or the

exclusion of "undesirable" groups, which might include low- or moderate-income

families and minorities, from living in certain communities. Though Fair Housing Act

(FHA) prohibits housing discrimination based on race, color, religion, sex, disability,

familial status, or national origin, discrimination based on economic status is not

protected by law. "A court will only overturn a zoning ordinance that excludes based on

economic status if it is coupled with a discriminatory impact on one of the protected

classes" (Durkin, 2006). Some advocates of smart growth and new urbanism believe

zoning's exclusive segregation and zoning is a primary cause of urban blight and

suburban sprawl (Wolf, 2008).

Yet comments on zoning were not unanimously negative. Simply saying zoning is

harmful or useful is arbitrary. In theory and practice, the views on the effects of zoning

on the housing market, benefits to property owners, land-use efficiency, the local

economy, and public welfare are divergent. The complication of land use means that

any regulation involving it cannot be without criticism. Zoning is still a "widespread and

enduring fact" (Steele, 1986, p. 716). Moreover, "Zoning is a nearly universal feature of

land-use regulation in the United States. Doubts as to zoning's legitimacy have long

since been transformed into general acceptance" (Cohen, 1995, p. 307). Zoning as a

regulatory tool of land use exerts its protective and proactive functions within the rule of

free market. "By the test of acceptance in the market place, zoning has been a

smashing success" (Babcock, 1966, p. 737). "Zoning, modified somewhat from its

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districts, other factors one might consider includes identities of exclusion, such as religion, gender, disabilities, etc. Low income families or minorities might face unreasonable costs if they live in certain areas because of zoning regulations.

Euclidean origins, remains ascendant to this day, despite nagging concerns about its effect on potential newcomers, on the real estate market, and on the needs of neighboring communities" (Wolf, 2008).

In addition, in order to cope with the side effects of zoning regulations, some other measures were developed. However, without a Supreme Court requirement, many states and courts have already begun making efforts through legislation in order to eliminate exclusionary effects (Durkin, 2006). Inclusionary/fair share housing policies are applied by many states to provide low- or moderate-income families with affordable housing under existing zoning regulations. For mixed-use land development, planning unit development (PUD) is designed to give the developer more flexibility to develop a large lot for multiple land use. Planning professionals take on more responsibilities in the design of PUD lots (Sampson, 2007). By using these tools, some negative effects of zoning could be alleviated or eliminated.

Since zoning ordinances cannot list all the possible situations individual properties might experience, their strict observation might have unfair or undesirable effects on individual properties. Zoning variance was designed as a tool to address the inflexibility of zoning and the problems that "one-size-fits-all" zoning ordinances cause (Sampson, 2007, p. 879). As zoning is a "nearly universal feature of land use regulation" (Cohen, 1995, p. 307), as mentioned above, zoning variance is also a "nearly universal feature" in zoning regulation (Sampson, 2007, p. 888). Zoning variance is a "tool to perfect a crude regulatory instrument" (Owens, 2004, p. 283). The legislative status of zoning variance is determined by each state's zoning enabling act. In zoning ordinance,

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variance is granted by certain administrative bodies[8] (quasi-judicial bodies[9]) according to rules and certain circumstances related to judgment ("Replacing the Hardship," 1987). Variance is derived from traditional Euclidean zoning[10] (Cohen, 1995). It is commonly thought that these functions were originally meant to be administrative "safety valves" (Burke & Snoe, 2004; Cohen, 1995; Reynolds, 1999; Shapiro, 1969) that protect the constitutionality of zoning ordinance. Also, it "prevents the city or county from being held liable under the Takings Clause[11] of the Constitution or the zoning ordinance, from being declared unconstitutional under the substantive Due Process Clause of the Constitution" (Burke & Snoe, 2004, p. 531). Variance was "seen as a pragmatic means of taking individual disputes out of the political and judicial realms that would likely be less hospitable to effective zoning practice" (Owens, 2004, p. 284). Property owners should first apply for variance before they claim hardship to the courts ("Zoning Variance and," 2005).

Today the application of zoning variance has greater benefit for the community and property owners, as it is "designed as an escape hatch from the literal terms of the ordinance which if strictly applied, would deny a property owner all beneficial use of his or her land and thus amount to confiscation."[12] The variance is a "permitted violation of the zoning regulations" (Shapiro, 1969), which is a way to "correct maladjustments and

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[8] Ibid. p.9.

[9] "The quasi-judicial function resembles that exercised by a judge, and typically is denoted by public hearings for which notice is given and an opportunity to be heard is provided, as well as the application of the particular facts of the case Being heard to specific, preexisting criteria established by law" (Sampson, 2007, p. 878).

[10] "Euclidean zoning refers to that type of zoning characterized by the identification of use-based zones, traditionally residential, business, and industrial. Uses are typically allowed hierarchically, that is, uses allowed in a 'higher' zone are permitted in a 'lower' zone, but not vice versa" (Cohen, 1995, p. 330). Additionally, height and area regulations are also seen as Euclidean zoning (Wolf, 2008).

[11] In the Fifth Amendment: "No person shall be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use without just compensation."

[12] (Owens, 2004), citing Lincourt v Zoning Bd. of Review, 201 A.2d 482, 485-86 (R.I. 1964)

inequities in the operation of general regulations"[13] and "the main purpose of allowing variances is to prevent land from being rendered useless" ("Zoning Variances," 1961). In addition, the variance helps property owners to avoid complicated procedures when they face hardships under existing zoning regulations. "The variance is a simple, cost-effective means of providing such relief without the necessity of either ordinance amendment or litigation" (Owens, 2004, p. 371).

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Zoning Variance

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Definition of Zoning Variance

The description of "zoning variance" is usually shown in state or municipal zoning ordinance act, land use law book, and on the website of local planning and development service agencies. The author summarized four main elements which are usually contained in the definition of zoning ordinance: the attribute, applicant, objects affected, and granter.

The first element is variance's attribute. Zoning variance is an authorization (Salkin, 2008). It is a constitutional grant. It is also a relief from zoning ordinance, which relieves the applicant from strictly abiding by zoning code (Salkin, 2008). For example, the BZA grants an application proposing to decrease the number of parking spaces below the required minimum number based on the existing building, land area and surrounding open space. If zoning ordinance was strictly applied, this building would be rendered useless.

The second element is the applicant of variance. Some in the literature say it is individual, some specify it to be the property owner or land owner, and some just refer to applicant (Burke & Snoe, 2004; Donovan, 1962; Madry, 2007; Mandelker, 2003;

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[13] (Salkin, 2008), citing Visco v. City of Plainfield, 136 N.J.L. 659, 57 A.2d 490 (N.J. Sup. Ct. 1948)

Reynolds, 1999; Shapiro, 1969; "Zoning Variances and Exceptions: The Philadelphia Experience," 1955). According to zoning orders[14] in Washington, D.C., an applicant could be an individual, a for-profit organization, or non-profit organization. In New York City, the applicant could be "any person aggrieved" or be "the head of any agency" (State of New York Legislative Bill Drafting Commission, 2004, p. 177).

The third element involves the objects affected. In accordance with zoning ordinance, variance affects both buildings and lands within zoning districts. When an applicant applies for variance, it must be "based on the physical condition of the land" ("Zoning Variance and," 2005, p. 209). It could be variance on building, or variance on land, or on both. For example, variance on building could relate to the number of stories (or height); variance on land could relate to lot area (or width); variance on both could be use (or lot occupancy). It also means the determination of variance application is based on the condition of the property, not the condition of the property owner. The decision should not be different on the same property due to differences between owners' circumstances.

The fourth is the granter. The granter is an administrative body usually named "Board of Zoning Adjustment," which is an independent quasi-judicial agency in charge of granting variances, special exceptions, and appeals "related to the enforcement or administration of the zoning ordinance" (Salkin, 2008; "Zoning Variances and Exceptions: The Philadelphia Experience," 1955).

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[14] Available on DC Office of Zoning website, http://dcoz.dc.gov/main.shtm

In brief, a variance is an administrative authorization to relieve the characteristics of zoned property from strict accordance with zoning regulations under the application of property owner[15].

Type of Zoning Variance

Variances occupy two categories. One is area/bulk/dimensional variance[16]; the other is use variance (Barry, 1993; Burke & Snoe, 2004; "Zoning Variances," 1961). The former refers to the modification of physical characteristics related to building or land or relationship between both (e.g., front yard, lot occupancy, height, story, open space, etc). The latter grants uses prohibited by zoning ordinance.

Use variance can also be classified into two types. One is to establish or continue a use (e.g., establish a fast food restaurant in the district limited to residential use); the other is to change an existing use to another which is currently prohibited ("Zoning Variances and," 1955) (e.g., change use from a convenient store to a restaurant in a residential district).

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[15] Some definitions of variance:
 A variance is "an administrative grant allowing an individual to use his land in a manner not permitted by a strict application of the zoning classification created by the legislative body" (Donovan, 1962, p. 103).
A variance is "an authorization to use property for a purpose prohibited by the zoning ordinance; and a use which is authorized by a 'variance' is not personal or limited to a particular owner of the property but rather 'runs with the land.' " Balodis v. Fallwood Park Homes, Inc., 64 Misc. 2d 936, 283 N.Y.S.2d 497 (Sup 1967).
A variance is "an official quasi-legislative, quasi-judicial determination that the use allowed is not offensive to the zoning ordinance with regard to the particular circumstances" Industrial Lessors, Inc. v. City of Garfield, 119 N.J. Super. 181, 290 A.2d 737 (App. Div. 1972).
"Variances are the principal administrative device for granting relief to individual property owners from the unnecessary harshness of zoning laws" (Reynolds, 1999, p. 127).
 A variance is "an authorization for the construction or maintenance of a building or structure, or for the establishment or maintenance of a use of land, which is prohibited by a zoning ordinance. It is granted by an administrative body pursuant to power vested by statute or ordinance, and is a form of administrative relief from the literal import and strict application of the zoning regulations. A variance runs with the land and passes with the land to a subsequent purchaser" (Salkin, 2008, volume 13-3).
[16] It also has other synonymic labels: "yard variance," "zoning variance," "structural variance," "nonuse variance," and "site design variance" (Sampson, 2007, p. 881).

Variances are not classified according to a universal standard in the United States. In fact, sometimes it is vague. As a result, it is hard to categorize on-site parking, signs, and density into those two types ("Replacing the Hardship," 1987). For example, parking and floor area are treated as use variance in some states, while in others they are treated as area variance. The classification is "dependent on the language of the zoning ordinance the variance is requested from. If the zoning ordinance acts merely prohibits the use, then the requested variance is a use variance" (Salkin, 2008, volume 13-15). Currently "eighteen states do not distinguish between use and area variances either legislatively or judicially" (Salkin, 2008, volume 13-18) ; eight states have different standards for area variances and use variances; twelve states prohibit use variances; "three states have unique provisions governing the issuance of variances" (Salkin, 2008, volume 13-34); "other states statutorily give local municipalities and entities the power to allow or disallow use permits in their local ordinances" (Salkin, 2008, volume 13-36).

It is commonly thought use variance is contrary to the purpose of establishing zoning regulations. Some courts views use variance is "a greater threat to the integrity, and fairness, of a zoning scheme than area variances" (Cohen, 1995). Furthermore, use variance "generally possesses a greater potential to enable a landowner unfairly to receive a substantially larger return on property than a similarly situated landowner who cannot engage in the use" (Cohen, 1995, p. 331). As a result, some states do not allow use variance.

Disadvantages of permitting use variances

One reason some jurisdictions do not allow use variance is that to allow use variances on the theory constitutes rezoning[17], and rezoning is a legislative function. "The authority of a board of adjustment to issue a use variance turns on whether the court finds that the legislature intended to confer such power and whether such a grant of power is an unconstitutional delegation of legislative authority" (Juergensmeryer & Roberts, 2003, p. 188). Granting of use variances might constitutes an improper amendment of the zoning ordinance and use variances would usurp the amendment power (Mandelker, 1997).

Besides, it is commonly thought use variances are contrary to the purpose of establishing zoning regulations. "The rationale is that an area variance does not threaten adjacent land with the establishment of an incompatible use, or with maintenance of a use that will change the character of the neighborhood" (Salkin, 2008, volume 13-17). Especially for the large lots and where the proposed use is not otherwise allowed anywhere in the city. If such kinds of variances are granted, the changes on the local community are huge. Field studies also found substantial abuses in the granting of use variances (Mandelker, 1997). Also there were arguments that though the proposed use would be advantageous to the public, the board is not empowered to decide what the public needs (Juergensmeryer & Roberts, 2003).

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[17] See "Zoning Variance and Rezoning" in this chapter.

Advantages of permitting use variances

First, use variances embrace the purpose of setting variances in the zoning regulation. Some properties might encounter unnecessary hardship if strictly abide by the ordinance and the denial of use variances might constitute a taking.

> Where use variances are allowed, the courts find the guidelines spelled out in the enabling act sufficiently circumscribe the decision-making power of the board to overcome the unconstitutional delegation problem. The grant of the use variance, where permitted, is not viewed as an uncontrolled discretionary act but, rather, one that is limited by the necessity to find that unusual conditions exist. Other courts have also rejected the unconstitutional delegation theory. (Rohan, 1990, p. 43)

Bair (1970) showed that a proposal to prohibit use variance in a city met strong opposition from "the board, the city attorney, and local real estate interests, who held that the board was being illegally stripped of its powers" (p. 479).

Second, use variances insert efficiency and flexibility into the zoning system. "A variance may be faster and cheaper than a rezoning, and it may require less paperwork and fewer hearings before fewer bodies" (Juergensmeryer & Roberts, 2003). Especially in the highly developed urban areas, more and more redevelopment happens and the needs for use variances are increasing. It is found that the application for use variances in New York City increased dramatically. In 2001-2002, around 64% of applications were use variances, while in 1976 the percentage was 28% ("Zoning Variance and," 2005). If use variances are prohibited, it would increase tremendous burden on the legislative bodies to amend the map and rezone areas frequently. Bair (1970) showed the city attorney stated (not for publication) that issuance of use variances was

convenient because it relieved the governing body of the necessity for considering a great many zoning amendments. The above indicates use variance is still very popular in some places.

For the states that allow use variance, the BZAs are usually stricter in granting use variances compared to area variances (Burke & Snoe, 2004). Some jurisdictions also have stricter standards compared to area variances. In some jurisdictions, use variances are only prohibited where the change to be allowed is significant (Rohan, 1990). "The size of the parcel affected by the variance was a controlling factor in most of these case" (Mandelker, 1997, p. 252).

Some scholars also point out it is arbitrary to say use variances are more harmful than area variances. In a low density residential area, the negative influence to granting 10-story addition is more than the granting of one-seat hair style salon in a residential building.

Conditions to Grant Zoning Variance

SSZEA is thought to have created "some of the first definitive criteria serving to better define the circumstances under which granting a variance would be justified" (Sampson, 2007, p. 890). Under the guide of SSZEA, local legislative bodies make their own zoning ordinances. Different states have different jurisdictional structures that govern the granting of variances; some are under the governance of state statures, while others are under municipal law. In addition, under different jurisdictions, the conditions to grant variance also vary. Salkin (2008) summarized this well and presents a complete list of states.

Though a variety of tests are used in granting variance, most states share some commonalties:

(1) The variance must not be contrary to public interest, safety, and welfare (Burke & Snoe, 2004; Donovan, 1962; Madry, 2007; "Zoning Variances and Exceptions: The Philadelphia Experience," 1955). This condition is in accordance with the principal purpose of zoning ordinance.

(2) The variance would not be "substantially incompatible with the comprehensive zoning plan" (Burke & Snoe, 2004, p. 532). One of the conditions for "any zoning ordinance is that it be in accordance with a comprehensive plan" (Madry, 2007). Though variance is an exemption from the zoning regulations, it still needs to observe the spirit of comprehensive zoning plan.

(3) The strict application of zoning regulations would result in an undue/unnecessary hardship on the applicant (Burke & Snoe, 2004; Donovan, 1962; Reynolds, 1999).

An applicant must satisfy each of these conditions to get the permission of variance. The important part in the above conditions is the term "undue/unnecessary hardship," which is the key test to grant a variance. It is the most common standard in zoning variance widely used in the United States (Cohen, 1995). Barry (1993) indicates the classic statement of hardship tests occurred in 1939 New York case of Otto vs. Steinhilber and it has been widely adopted in practice:

> Before the board may ... grant a variance upon the ground of unnecessary hardship, the record must show that (1) the land in question cannot yield a reasonable return if used only for a purpose allowed in that zone; (2) that the plight of the owner is due to unique circumstances and not to the general conditions of the neighborhood which may reflect the unreasonableness of the

zoning ordinance itself; and (3) that the use to be authorized by the variance will

not alter the essential nature of the locality. (p. 46)

This Otto vs. Steinhilber test is not universally applied by every zoning ordinance,

but it does have great influence and is considered to be the "classic statement"

(Mandelker, 2003).

Two terms are key to explaining undue/unnecessary hardship. The first is

"reasonable return." A "reasonable return" refers to fair return/profitable return, and "the

most firmly entrenched and reiterated declaration is that mere financial hardship or an

increased return from the property is not a sufficient reason for granting a variance"

("Zoning Variances and," 1955, p. 520). Yet some courts use "reasonable use" instead

of "reasonable return," or interpret both to have the same meaning. A property that

would not be suitable for use if it strictly abided by the existing zoning regulation could

be a justification of hardship (Jacobs, 1958). If it is shown that the zoning regulation

leads to the denial of all reasonable use, it actually equals a constitutional taking. In

practice, most "courts will generally approve the grant of a variance where the

landowner would otherwise be denied the reasonable use of his or her property" (Cohen,

1995, p. 309). In Connecticut, applications "to add a pool, porch, or addition to an

existing structure" ("Replacing the Hardship," 1987, p. 680) could not be seen as

reasonable use. Usually applicants need to show enough evidence that their properties

cannot yield reasonable use. "Sustained unsuccessful efforts to sell a property for

permitted uses are often deemed a sufficient basis upon which to find that a reasonable

return is not possible" (Cohen, 1995, p. 197). The Michigan Court of Appeals demands

"the landowner must show no reasonable return, hardship amounting to confiscation, or

the deprivation of all reasonable use" (Cohen, 1995, p. 187). Cohen (1995) also shows

New York State Court of Appeals listed some elements which the property owner needs

to present in the application of variances as justification of no reasonable return, which

is anecdotally called "dollars and cents evidence" ("Zoning Variance and," 2005, p. 210).

These factors are: "(1) the amount the applicant paid for the entire parcel; (2) the

present value of the parcel or part of it; (3) maintenance expenses; (4) taxes on the land;

(5) mortgages and encumbrances; (6) income; and (7) other relevant factors, including

the applicant's estimate of what constitutes a reasonable return" (Cohen, 1995, p. 336).

"Courts have considered 3.6%, 6.9% and 9.9% as a sufficient rate of return,

emphasizing that different circumstances may dictate a different rate of return" ("Zoning

Variance and," 2005, p. 210).

The second is "unique circumstance." Burke & Snoe (2004) explain that the relief

for which the applicant applies does not share the general characteristics of the

neighborhood. However, it does not mean that the property is the only one possessing a

particular undue/unnecessary hardship. If a given hardship occurs in the entire

neighborhood, it "may reflect the unreasonableness of the zoning ordinance itself"

(Cohen, 1995, p. 180) and may require the zoning legislative agency to amend the

zoning regulation for a solution. The BZA does not have the authority to address a

neighborhood's hardship. The unique circumstance requirement is an

acknowledgement by the jurisdiction that zoning variance might inevitably cause

hardship to certain property owners and requires the BZA to exert administrative

mechanisms to address this issue (Cohen, 1995). It could not be considered a unique

hardship if an applicant presents proof of inappropriateness of zoning regulations.

Furthermore, this unique hardship should not be self-created (or self-imposed, self-inflict, self induced) by the owner. Rather, it is related to the property rather than the owner's situation (Jacobs, 1958; Reynolds, 1999; Rice, 2006). A hardship is considered self-created "if property is purchased subject to restrictions that are sought to be varied, and the applicant was aware or should have been aware of the zoning restrictions at the time of purchase" (Rice, 2006, p. 1127). "The United States Supreme Court has addressed this and rejected a firm rule that bars a taking or hardships claim based on the purchase of property subject to the land-use restrictions at issue" ("Zoning Variance and," 2005, p. 211).Another situation is considered to be self-created: the "applicant's violation of the ordinance, knowing or unknowing, and his subsequent application for a variance based upon his expenditures [is] the hardship suffered. Unless the applicant is otherwise entitled to a variance, relief will be denied" (Jacobs, 1958, p. 822).

In the Otto vs. Steinhilber test, the third requirement (i.e, that "the use to be authorized by the variance will not alter the essential nature of the locality") reflects zoning's protective function. The essential nature here includes "views, congestion, community character, noise, building size, architectural design, and environmental issues" ("Zoning Variance and," 2005, p. 210), as well as aesthetic concern. However, "courts focus not so much on the impact, but on the purpose of the regulation and the interests and values sought to be protected" (Cohen, 1995, p. 337).

In hardship tests, New York City requires one more condition for applicant to demonstrate hardship: "the variance requested is the minimum variance required to alleviate the hardship" ("Zoning Variance and," 2005, p. 207). It reflects the principle of

preserving zoning integrity and minimizing the negative influence the variance might cause. However, this test is not a strict requirement, even by court.

Besides undue/unnecessary hardship, practical difficulty is another standard adopted by some states and administrative bodies usually apply it in practice. Practical difficulty is seen as a more lenient and relaxed standard compared to undue/unnecessary hardship since it emphasizes the feasible use of property (Burke & Snoe, 2004; Madry, 2007). As mentioned above, area variance does not vary the main characteristics of a community (compared to use variance), so some states use practical difficulty as a standard to test area variance. In the case Village of Bronxville v. Francis, the court, for the first time, applied practical difficulty standard to support area variance (Sampson, 2007). In many states, practical difficulty is employed for matters relating to area variance and undue/unnecessary hardship is employed for matters relating to use variance (Barry, 1993; Burke & Snoe, 2004; "Seeking a Variance as a Prerequisite to Challenging a Zoning Ordinance," 2000). This standard also "reflects the general policy disfavoring use variances" (Cohen, 1995, p. 339). Salkin (2008) cited the case Anderson v. Board of Appeals, Town of Chesapeake Beach[18], which gave a relatively thorough explanation about practical difficulty:

> For practical difficulty, the applicant need show only that (1) compliance with the strict letter of the restrictions would unreasonably prevent the owner from using the property for a permitted purpose or would render conformity with such restrictions unnecessarily burdensome; (2) a grant of the variance applied for would do substantial justice to the applicant as well as to other property owners

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[18] Anderson v. Board of Appeals, Town of Chesapeake Beach, 22 Md. App. 28, 322 A.2d 220 (1974).

in the district; and (3) relief can be granted in such fashion that the spirit of the

ordinance will be observed and public safety and welfare secured. (volume 13-28)

New York courts use several factors to test area variance under the practical

difficulty standard:

the economic impact on the landowner, the extent of the variance, the effect on

the neighborhood, and whether the landowner could pursue alternative

means…If the landowner shows that denial of the variance would simply cause

economic harm, the burden shifts to the municipality to show that application is

necessary to advance the purpose of the ordinance or prevent injury to the public.

(Cohen, 1995, p. 340)

Administrative Body

Since zoning ordinances enacted by states cannot cover every conceivable

situation, most states authorize local municipal agencies or communities to establish

their own administrative bodies to "to vary the application of the provisions of the zoning

ordinance" (Jacobs, 1958, p. 821). This setting is good for addressing local problems on

a case-by-case basis (Durkin, 2006; Gardner, 2004). The state-level agency has the

right to review the decisions made at the local level to guarantee the integrity and

observance of state zoning enabling statutes. The Board of Zoning Adjustment is

delegated to authorize zoning variance by state or municipal legislative bodies. Aside

from making decisions on whether to grant variance or not, the BZA also assumes other

responsibilities, such as granting special exception[19] and hearing appeals related to the

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[19] Special exception is a use allowed by the provisions of the zoning ordinance under some conditions. It must get approval from BZA to make sure this use does not bring negative effects to the neighborhood.

enforcement or administration of the zoning ordinance. Usually five or seven members are elected or appointed to compose the BZA.

In Washington, D.C., the BZA is composed of five members, three of which are mayoral appointees, one a rotating member of the District of Columbia Zoning Commission, and one a designated representative of the National Capital Planning Commission[20]. In New York City, the board also consists of five members featuring at least one professional and experienced planner, one architect and one engineer. The final decision can be made with at least at three members present (State of New York Legislative Bill Drafting Commission, 2004). The BZA does not have the authority to amend zoning ordinance in a manner that changes the essential character of a community, nor can it review "the legislative body's record or provide an appeal from their decision" ("Seeking a Variance," 2000, p. 2033). The state courts are "the only bodies which have direct appellate review over zoning boards…Judicial review provides the state and the public with a way to hold zoning boards' actions up to a standard of reasonableness" (Gardner, 2004, p. 423).

Usually there are two steps in zoning variance administration. The first step is to determine whether the application for a building conforms to the zoning code. If it conforms, the building permit is granted. This step is done by another zoning agency as opposed to the BZA. If the application does not conform to the zoning code, then the applicant must amend the original plan and resubmit the application for approval. Alternatively, the applicant may go on with the second step to apply for a zoning variance or special exception from the BZA ("Administrative Discretion in Zoning," 1969). Usually, the cases the BZA reviews should first be reviewed by other zoning agencies to

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[20] District of Columbia Office of Zoning, http://dcoz.dc.gov/services/bza/bza.shtm

determine if they do or do not conform to the zoning code. Once the review is completed, a public hearing is required for public testimony. The purpose of public hearing "is to allow for an open discussion of variance application" (Witten, 2007, p. 25). In order to grant a variance, it is required by ordinance a certain number of the board members vote to grant. Ordinarily, for boards consisting of five members, if majority of the three vote to grant, the variance is approved. However, the regulations are different in different states and cities. In Denver, the board is composed of five members. Application of variance can only be granted when at least four members vote for approval (Sampson, 2007).

In most states, the BZA shall grant an application, grant an application subject to conditions, or deny an application at their discretion. In New York City, the variance previously granted could be revoked or modified "if the terms and conditions of such grants have been violated" (State of New York Legislative Bill Drafting Commission, 2004, p. 175). An interesting finding is that in 2001 and 2002, all the grants in New York City were conditional ("Zoning Variance and," 2005). This might reflect that the board aimed to keep changes to neighborhoods to a minimum, while giving the applicants opportunities to make some changes under the existing zoning ordinance.

In the previously mentioned conditions where a variance is granted, there is no explicit line defining whether a variance is contrary to public welfare, whether it is substantially incompatible with a comprehensive plan, or whether it meets undue hardship or practical difficulties. Though many courts explained and showed tests of undue hardship and practical difficulties, the descriptions of these two terms are still not very clear or strict.

State courts have not dealt kindly with discretionary elements in zoning....many

courts have condemned new discretionary plans on grounds either that the

legislature may not constitutionally delegate its power to administrative bodies, or

that the states' zoning enabling act does not purport to authorize such

discretion...Courts cannot interpret vague standards such as 'general welfare'

any more satisfactorily than appeal boards, nor have they developed more

precise standards to guide the boards in granting exceptions and variances.

("Administrative Discretion in Zoning," 1969, p. 682)

Since it is the BZA's responsibility to consider the aforementioned factors, the

members in the BZA are final decision-makers. Different members might have differing

opinions based on their own discretion. Though they do not have the power to amend

the zoning ordinance (Burke & Snoe, 2004), they have the power to grant or deny

variance based on their own comprehension of zoning ordinances and the situation of

properties. Because it is impractical "to adopt a zoning law that is both completely

'definitive and all-encompassing' for every situation, 'a reasonable amount of discretion

in the interpretation of the [zoning law is] delegated to an administrative body or

official.'"[21] The general standards for granting zoning variance implies that the essence

of the zoning variance is its flexibility ("Administrative Discretion in Zoning," 1969) – a

way to handle different situations is in reality based on the context and each case's

special situation.

If the purposes of zoning are to be accomplished, the master zoning restrictions

or standards must be definite while the provisions pertaining to a conditional use

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[21] (Rice, 2006, p. 1137), citing Arceri v. Town of Islip Zoning Bd. of Appeals, 16 A.D.3d 411, 412, 791 N.Y.S.2d 149, 151 (2d Dep't 2005).

or a variance, designed to relieve against uncertain eventualities, must of necessity be broad and permit an exercise of discretion.[22]

Reynolds (1999) said, "the power to grant or deny lies in the discretion of the members of the board of adjustment, and their exercise of this discretion will not be overturned unless they act arbitrarily, capriciously, or outside the scope of their authority" (p. 128). In Connecticut,

> This deferential standard has been further relaxed by what might be called the 'honest judgment' test, established by a line of cases requiring the trial court to uphold a ZBA[23] decision as long as 'honest judgment has been reasonably and fairly exercised after a full hearing. ("Replacing the Hardship," 1987, p. 688)

It implies that while the decision made by the BZA might be controversial, the court might not reverse the BZA's decision as long as they do not abuse their broad discretion (Gardner, 2004). In New York City, a study showed that the board's decisions on variances were frequently supported by courts in judicial cases over a relatively lengthy period (from 1962 to 2003). The exact percentage of cases upheld by courts was 85%. "Courts are deferential to BSA decisions, as they generally are with governmental decision-makers" ("Zoning Variance and," 2005, p. 230).

Zoning Variance and Rezoning

Zoning variance and rezoning are two different concepts. Rezoning (or "zoning amendment", or "mapping units") "is similar to a use variance in that it permits a use which is not allowed by the provisions of the zoning ordinance. However, while a use

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[22] ("Administrative Discretion in Zoning," 1969, p. 671), citing Tustin Heights Ass'n v. Board of Supervisors, I70 Cal. App. 2d 619, 634-35, 339 P.2d 9I4, 924 (Dist. Ct. App. 1959)
[23] In Connecticut, the administrative body is called Zoning Board of Appeal (ZBA).

variance grants the owner an exemption (and leaves the ordinance intact), an amendment changes the ordinance itself" (Barry, 1993, p. 55). Usually rezoning is used for a relatively large area which is not suitable for use under existing zoning regulations.

The decisions on zoning variance and rezoning are usually managed by different public bodies. In Washington D.C., the BZA is the administrative body to decide whether to grant or deny a zoning variance. The Zoning Commission (ZC)[24] is in charge of preparing and adjusting zoning map. The process between zoning variance and rezoning is also different. Zoning variance is first proposed by an applicant, who has definite request about "violating" one or more certain regulations in zoning code. Rezoning is initiated by the public agency which is in charge of rezoning, based on economic and social changes and existing situation of an area. If a residential district shows serious blight and a large number of population moves out of the area, it may reflect that the area is not suitable for existing zoning function. When there is clustering of zoning variances, especially use variances, it might show the sign that the whole area is not suitable for existing zoning setting.

Criticism of Zoning Variance

In the practice of zoning variance, it seems that zoning boards focus more on flexibility as opposed to rigid discretion in every test. As early as the mid-1930s, variance practices were criticized as "easy and erratic."[25] Madry (2007) described zoning variances more strongly, calling them "notoriously badly administered" (p. 486). The vague standards in determining whether applications satisfy the conditions "encouraged the exercise of considerable discretionary power by zoning boards"

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[24] In Chapter 4 the author will provide more information about the functions of each public agency.
[25] (Shapiro, 1969, p. 9). Citing Woodruf, A Zoning Primer 66 (Proceedings of the Annual Planning Conference 1935)

("Administrative Discretion in Zoning," 1969, p. 668). The BZA has also been described as too lenient with applicants whose grants are wild and liberal ("Building Size, Shape," 1951; Reynolds, 1999), and can generate a decision which "bears little resemblance to zoning theory or legal norms" ("Administrative Discretion in Zoning," 1969, p. 668). Since some of the board members are appointed or elected from the neighborhood, they have "a natural disposition not to be too harsh" ("Zoning Variances," 1961, p. 1407) on their neighbors. In Michigan state, the members of Zoning Board of Appeals appointed by local government are not required to be familiar with land-use policies and regulations ("Seeking a Variance," 2000). In Connecticut, most of the board members do not have formal training ("Replacing the Hardship," 1987). The unprofessional backgrounds of some members, combined with political bias and pressure, can lead to inappropriate or controversial zoning decisions (Gardner, 2004).

It is also noted that the unique circumstance is "no longer a significant aspect of the test for a variance" (Madry, 2007, p. 490). Regarding the test for undue/unnecessary hardship, it becomes a balance between the stakeholders. Many administrative bodies "viewed the variance as a useful tool for balancing individual and community needs in a variety of circumstances rather than a device limited to amelioration of significant hardship" (Owens, 2004, p. 295). Applicants might easily gain approval if there is no opponent. Some sample data collected in various cities showed the rate of approval was very high as a proof of improper usurpations of power by the BZA.[26] Though the high approval rate does not alone indicate the improper decisions by the board, "that suspicion seems particularly well-placed, given the relatively strict standards of the

[26] Reps, Discretionary power of the board of zoning appeals, 20 Law & Contemp. Prob. 280,281, 1955

traditional variance approval criteria" (Sampson, 2007, p. 893). In a study of misrule, it

was estimated that for applications of area variances granted in 1961-1962, "on the

basis of the facts alleged in the petition and the evidence in the minutes, in not more

than twenty, or approximately forty percent, of these cases were the legal requirements

for a variance satisfied" (Dukeminier & Stapleton, 1962, p. 287). In Connecticut, the

board displays lenience toward residential applicants, who usually apply for "new

swimming pools, garages, porches, or family rooms added to existing homes"

("Replacing the Hardship," 1987, p. 691). In New Hampshire, it was found by the New

Hampshire Supreme Court that 10% of variance grants were illegal during 1987 to 1992

(Kent, 1993). Especially in cases when the applicants plan to demolish and rebuild their

houses using area variances, they might get great support from the neighborhood, since

new, good-looking buildings can help to increase surrounding property values. In this

situation, the boards might weigh more heavily the benefits provided to a community

versus the strict interpretation of zoning regulations (Durkin, 2006). It was confirmed by

a planner in New York City that the board works with city planners to "weed out

inappropriate submissions and improve the process" ("Zoning Variance and," 2005, p.

208), which might be another reason for the high approval rate. Also, the decision-

making process does not provide public participation. Though the public hearing is a

channel between the community and decision makers, variance approval still depends

on the zoning members' final decision ("Administrative Discretion in Zoning," 1969) .

Though the effect of individual zoning variances on a community might seem

insignificant, (particularly for area variances), the overall effect of all granted zoning

variances on a neighborhood could be remarkable. "The quasi-judicial nature of the

variance process often forces the board of adjustment to focus on the needs of the

petitioner and the impacts on immediate neighbors. What is often lost in such a process

is the view of cumulative impacts of variances on broader community interests" (Owens,

2004, p. 319). Neighborhood character could be changed drastically by the cumulative

effect (Sampson, 2007), such as perception of density, esthetic layout, etc. However,

the boards paid scant attention to this problem. The boards have an "intuitive sense that

the fabric of local zoning will probably not be damaged if a homeowner receives a

minimal variance" ("Replacing the Hardship," 1987, p. 719). In New York City, clear

evidence of clustering of variances showed up in some communities, which could lead

to further granting of variances there and open up the possibility of rezoning. The Board

is playing a role of "shaping land-use" and "become a source of unexpected change in

some communities, though it has never been authorized with this power by legislation"

("Zoning Variance and," 2005, p. 199). Another criticism is that while the granting of

area variances might help to increase surrounding property values, an improper

decision based on financial consideration may lead to exclusion (Durkin, 2006).

In the literature, most discussed the legislative issues related to zoning variances

and the discrepancy between theory and practice. Though it might be true that the BZA

is somewhat lenient in its decision-making and some factors might affect (or be highly

correlated with) final decisions, most studies list a variety of factors affecting the BZA's

decision-making separately and do not show to what extent each one affects the final

decision. Most studies use qualitative analysis with few data support. The author has

not found any study applying econometric analysis to testify their conclusion.

Furthermore, very few studies analyzed zoning variance decision from the time dimension. It is unclear how variance applications and decisions change over year.

Based on criticism of zoning variance, this paper focuses on zoning variance administration in practice in order to understand what factors influence the decisions of these boards in the approval or denial of variances. The author tries to determine the relationship between the BZA's final decisions and the characteristics of property, including type of variances, community's reaction, and related agencies' attitudes, etc. According to previous statements in literature, four hypotheses are proposed and will be tested by using quantitative analysis. Trends related to decision making on variances and the spatial distribution of zoning variances are also discussed in this paper.

CHAPTER 3
METHODOLOGY AND PROCEDURE

Research Design and Conceptual Framework

Based on a comprehensive review of the literature on zoning and zoning variance ranging from 1922 to 2008, the author will summarize facts and comments on zoning variance, as well as factors that might affect the BZA's decision making. Also, the methodologies used in each study will be examined and analyzed to determine better ways to test those facts and factors.

This paper summarizes the factors that are thought to affect the decision making of zoning variance rather than the requirements of existing law according to published literature. Four hypotheses are proposed, each of which is discussed extensively in the literature. A basic binary response model is built based on these statements. In addition, in order to test other possible factors that might affect decision making, the author tests another binary response model including more variables which might affect the BZA's decision. The binary response model is a model used widely in decision-making analysis in which the dependent variable is the response probability (e.g., the probability of buying a Japanese car). The independent variables include the factors that affect the dependent variable. The theory and application of this model will be introduced in the section on "Binary Response Model" in this chapter.

The next step was to collect data for analysis. Two methods can be used to collect data regarding the determination zoning variance. The first method was to summarize zoning variance cases during a period based on the official documents. Using the data, researchers could investigate the relation between the BZA decisions and other factors (e.g., arrival of protestors and letters of opposition from the neighborhood, type of

application. The advantage of this method is that it is objective. The shortcoming is we would miss some information which was not recorded in the documents. The second method is via survey. The surveyors send designed questions to the administrative officials and related agencies for their response. Using this method, some information that cannot be collected by the first way are made manifest (e.g., officials' knowledge of planning, engineering, and architecture, attitudes towards protestors, and other public agencies). Compared to the first method, this method is process oriented and the first method is result oriented. However, the deficiency of this method is that the responses might not reflect the participant's real thinking. The ideal approach is to combine the aforementioned methods. However, due to limitations posed by time and practicality, few researchers have used both. Owens and Brueggemann (Owens & Brueggemann, 2004) conducted a comprehensive survey about zoning variance experience in North Carolina, which provides a lot information about the views from board's members, other public agencies, and practitioners. This paper applies the second method as a complement to Owens and Brueggemann's study by focusing more on objective facts and the interrelationship between the BZA's decision and the quantitative independent variables.

Aside from data collection methodology, geographic scope of data and its time range also need to be considered. The cases examined could be limited within a certain administrative boundary, or in a larger region. The study could be one-year cases, or examine 10 or more years. The larger the geographic scope, the more generous and applicable the conclusion. The longer the time range, the more stable the conclusion. Also, with larger geographic scope and a long study period, one can determine more

characteristics of zoning variance. For example, one can compare the variance determination between two administrative bodies to ascertain commonalities and differences. Another example is that in the long-range study, one might find trends and changes in the variance determination. This study applies single-case study and the time period covers 30 years. The justification to use single-case study method is shown in "Case Study Method" in this chapter.

Washington, D.C. is the study area, and the author will review all 2140 variance cases from the 1980 through 2009. The documents of cases are available on the website of the District's Office of Zoning for public use, which includes information about lot's location, shape, type of variance, an applicant's statement, suggestions from the Advisory Neighborhood Commissions (ANCs) and the Office of Planning (OP), contents of public hearing, the BZA's decisions, etc. A spreadsheet will be created to store and organize this information for quantitative analysis. The reason to choose Washing, D.C. as the study area is explained in the section on "Case Study Method" in this chapter.

Once the data collection is complete, the data will be exported to the software programs, ArcGIS and SPSS. GIS is a database management system that is used to store, display, and analyze spatial data for decision making. ArcGIS is software produced by ESRI to perform the function of GIS. SPSS is also widely used software for quantitative analysis. The author will conduct data processing through ArcGIS for spatial analysis and SPSS for statistical analysis.

Based on the results processed from SPSS, the author will confirm or disprove the hypotheses proposed previously. Besides, the author will further investigate other

variables that might affect the BZA's decision. In addition, spatial analysis from ArcGIS will show the distribution of variance applications and decision.

Hypotheses

Approval vs. Denial

As mentioned above, many studies have found that the approval rates were significantly higher than the denial rates in different areas. Studies showed that from 1925 to 1940, the approval rate in large metropolitan jurisdictions was a little bit more than 50%. During 1945 to 1960, the approval rate increased to around 70%, which might relate to the rapid urban development after World War II. From 1960 through 1990, the approval rate remained in the range of 70-80% in different levels of jurisdictions (Owens, 2004). In New York City, the approval rate of variance was as high as 93% during 2001-2002, much higher than the 84% in recorded 1976 ("Zoning Variance and," 2005). Sampson (2007) listed 14 studies on variance approval rates in different regions from 1938 to 2004, and showed in most areas that the approval rates were more than 50%. In seven studies, the rates were more than 70%. Of the 14 total studies, 12 were conducted before 1970, and two were conducted in the 1980s, with the most recent study conducted by Owens in 2004. However, in Owens' study (2004), the study period was 1960-1990.

Based on the many statements about approval rate, the first hypothesis is listed as follows:

Hypothesis 1 - Granting of variance application is significantly higher than denial.

It is nearly common consensus that approval rates are the highest that they have been since 1920s. However, study of variances approval rates from 1990-2010 is rare.

With the exception of Owens's study, very few had long-range study periods. The change and trends of approval rates in an area are rarely noticed. In addition to testing the hypothesis with regard to total number, this project also tests the hypothesis over time.

Opponents from Affected Neighborhoods

The community's attitude towards the variance application is thought to be a very important factor that affects the BZA's decision making, especially regarding the reaction of opponents. "The appearance of protesters at public hearings has exercised considerable sway over appeal board decisions in this country. Special interest groups and public-hearing protesters might in large part balance each other in a system which indulged both" ("Administrative Discretion in Zoning," 1969, p. 680). In the absence of opponents in a public hearing, the ratio for granting variances was three times more than the ratio of opponents that appeared in the City of Philadelphia during the study period from July 1954 through September 1954 ("Zoning Variances and," 1955). The Zoning Board of Adjustment in Philadelphia granted 77% of applications without opponents present, compared to 24% with opponents present. In Boston, 81% were granted without opponents present, but 60% with opponents present ("Administrative Discretion in Zoning," 1969). Leary (1958) said "it is frightening to think that the criterion used by the Board of Appeals for approval or disapproval of variance applications is the presence or absence of protests" (p. 14). Shapiro (1969) also commented that the absence of opponents would be one reason that the Board granted variances in Baltimore. One board official stated that "the presence of protestants is the one factor which most frequently causes the Board to adhere to legal requirements for variations"

(Shapiro, 1969, p. 14). Madry (2007) cited "Wald's Statewide Rule of Four"[1] to support the view that opponents influence the boards' decision. This rule "permeates all Wisconsin cities [,] towns [,] and villages", and says that:

> If four or more persons appear at the ZBA[2] variance hearing in person or in
> writing objecting to the application, then the variance is always denied. The
> objectors don't have to be neighbors. They can live across town. There were only
> one or two exceptions to this rule in 85 communities over four years. (p. 488)

It is uncertain if the appearance of opponents denotes the application of zoning variance is incompatible with the local community. The opponents might represent individual interests based on individual preferences or they might represent an interest group that includes more residents' opinions. The latter might be a useful guide for the BZA to judge the influence the variance might cause ("Administrative Discretion in Zoning," 1969). Since the previously mentioned studies did not consider other factors that might also have affected the results, they do not provide convincing evidence about the extent the opponents' presence affected the final decision.

Hypothesis 2 - Opponents from affected neighborhoods influence zoning administrative board's decision making.

The opponents here could be neighbors, community organizations, and other related stakeholders[3]. They could choose to appear in the public hearing or send a letter expressing their objection. If enough required data about above information could

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[1] Wald Klimczyk is a city attorney in Janesville, Wisconsin. This rule was presented by him in the presentation Variances of Zoning Code Requirements: Current Practices by Wisconsin Cities, Towns & Villages (June 2000) (prepared for presentation to the League of Wisconsin Municipalities Institute).
[2] Here ZBA refers to Zoning Board of Adjustment.
[3] Oppositions by public agencies are not included here. Hypothesis 4 deal with the attitude of public agencies and their influences.

be acquired, this hypothesis could be tested using regression analysis. In addition, if this causal relationship exists to a significant extent, the degree of this relationship could also be estimated.

Area Variance vs. Use Variance

Some states do not allow use variance. For the states that allow use variances, it should be noted that the BZA is reluctant to grant use variances compared to area variances (Burke & Snoe, 2004). It is stated the use variance deviates from the purpose of zoning ordinance more than area variance. As mentioned previously, some states apply the standard of practical difficulty on area variance, which is already a less stringent standard in jurisdiction compared to use variance (Salkin, 2008).

Considering the above statements, a third hypothesis is will be tested:

Hypothesis 3 – Type of variance application affects the BZA's decision making.

This hypothesis only applies to the states that authorize use variance. It is not yet clear to what extent the BZA would grant area variance versus use variance. As mentioned above, some states apply the same standard to test both area variance and use variance application; some states already apply stricter standard to test use variance than area variance. No matter what standard they apply, whether use variance is less likely to be granted than area variance in terms of the BZA's decision is a way we can apply in both situations. It is not required by regulations that type of variance should be one criterion when the BZA make its decision.

Suggestions from Other Public Agencies

Some states require related public agencies and associations to submit analytical reports with recommendations for the BZA's consideration and final decision. These

agencies include planning agencies, transportation agencies, public work agencies, community associations, or historical preservation commission. In Washington, D.C., it is the responsibility of the Office of Planning (OP) to assess variance applications and present reports to the BZA. For some large development projects, the Office of Transportation also conducts analysis about congestion, parking and other traffic issues. As an outlet for citizen participation, the Advisory Neighborhood Commissions (ANCs)[4] also conduct meetings and propose their concerns to the BZA. It is often written in the BZA orders that it had "given great weight to the OP and the ANCs reports" for final decision-making. However, it is not a regulatory prerequisite to have an ANC report on file before the BZA makes a decision.

Shapiro (1969) has a contradictory view about the effects of other agencies' recommendations on the BZA's final decision. He said, "the advice of planners seems to have little effect on" (p. 11) the board in Baltimore. "The city's planning department might solve" the problem that the members of the BZA do not have enough knowledge in architecture and planning "by cooperating closely with the appeal board, but such coordination does not always occur" ("Administrative Discretion in Zoning," 1969, p. 674). The planning department has little effect on the board's determination ("Administrative Discretion in Zoning," 1969). In New York City, though City Planning is authorized to give recommendations to the board, it "exercises that authority infrequently" ("Zoning Variance and," 2005, p. 213). In the study of misrule, when planning staff recommended for approval, the decisions by board were always consistent with the board's decision. In contrast, the board had sharp disagreement with planning staff when the planners did not support the applications. The planning staff

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[4] The District is divided into 37 ANCs.

recommended denying 75 applications in a total of 102 applications during 1960-1961. However, the board only denied 26 (Dukeminier & Stapleton, 1962). In a survey about variance decision making in North Carolina conducted by Owens, within the 441 jurisdictions' responses, only 7% reported the final decision making by zoning boards were always consistent with other public agencies' suggestions. (Owens, 2004) However, it does not mean the final decisions were contrary to other public agencies' recommendations. This percentage means 7% of zoning boards highly correlated to those recommendations. For other zoning boards, though their final decisions might be the same as those recommended, their decisions were often based on other considerations.

Most of the existing literature indicates that the BZA are reluctant to accept recommendations from other public agencies, but some states require the BZA to consider other public agencies' recommendations. The third hypothesis is proposed as follows:

Hypothesis 4 – The zoning administrative board does not place significant weight on the suggestions of other public agencies in its decision making

The ideal way to test this hypothesis is to conduct a survey about the weight that members of the BZA put on related agencies' attitudes, as was done with the Owens's (2004) study. However, the results observed using this method might not be true, since members might not reveal what they really think. Another method involves probing the correlation between public agencies' recommendations and the BZA's final decision. The deficiency of this method is also apparent: one can know the correlation between

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the BZA's decisions and other public agencies' suggestions, but we cannot definitively say that the BZA's decisions were or were not determined by these suggestions.

In addition to the above issues in the determination of zoning variances, there are other factors that might affect the final decision. As mentioned above, the political and social background and subjectivity of board members could be important factors in their decision making. However, these are hidden factors, since it is hard to examine such causal effects. The high value of proposed buildings might be approved for zoning variance more easily than those of lower value.

> In Boston, the board granted eighty eight percent of requested variances for buildings with an estimated cost of over $10,000, as compared with seventy-four percent of those for buildings costing less than $10,000. Even more strikingly, the applications granted comprised only eighty one percent of the buildings by number, but ninety-seven percent of the dollar value of the estimates. ("Administrative Discretion in Zoning," 1969, p. 675)

Also, Owens (2004) found the population of cities has positive correlation with the approval rates. Limited by the methodology and data available to the author, some factors cannot be tested. For a more comprehensive understanding of zoning variance decision-making, other efforts will need to be conducted.

Binary Response Model

Introduction of Binary Response Model

In social science, researchers are always interested in the factors that affect the final decision of an individual or a group. Some decisions only have two choices. For example, a family decides to buy a house or rent a house; a student decides to go on with higher education or not; or a dissertation supervisory committee makes the doctoral

student to be a candidate or not. A binary response model (or binary choice model) is usually used in the above econometric analysis in which the dependent variable is a dummy variable that takes only two values, 1 or 0. The mathematic expression of a binary response model is usually as follows:

$$P(y_i = 1|\mathbf{x}) = F(\mathbf{x}\boldsymbol{\beta})$$

P denotes the probability when the dependent variable equals to 1; x denotes the vector of independent variables $\{x_1, x_2, \dots, x_i\}$, and i is the number of independent variables; $\boldsymbol{\beta}$ is vector of parameter; F denotes the functional form of independent variables. The simplest functional form is linear regression:

$$P(y_i = 1|\mathbf{x}) = \beta_0 + \mathbf{x}\boldsymbol{\beta}$$

In practice, the linear regression model is no longer applied since it has serious shortcomings. In addition to being a linear regression model, a binary response model is referred to as:

a probit model if F is the cumulative normal distribution function. It is called a logit model if F is the cumulative logistic distribution function. The logistic and normal distributions are both symmetrical around zero and have very similar shapes, except that the logistic distribution has fatter tails. As a result, the conditional probability functions are very similar for both models, except in the extreme tails. (Horowitz & Savin, 2001, p. 44)

Model Building

A binary response model is a good model to be applied in this study since decision making on zoning variance applications has two different results: grant[5] or deny. In regards to the functional form of model, we can use both probit and logit models. In Chapter 5, how to design and choose model will be explained in detail.

According to the four hypotheses proposed in the last section of this chapter, a simple binary response model is built as follows:

$$P(y = 1) = F(\beta_1 O, \beta_2 S, \beta_3 T)$$

$$y = \begin{cases} 1, & \text{Denial} \\ 0, & \text{Grant} \end{cases}$$

O: opponent

S: suggestion from other public agencies

T: type of variance (use variance, area variance)

This basic model is a first step for further investigation of the factors that affect the BZA's decision. Since this study also tries to determine other possible factors, an improved model is built for testing:

$$P(y = 1) = F(\alpha_1 O, \alpha_2 S, \alpha_3 T, \alpha_4 A, \alpha_5 V, \alpha_6 TP, \alpha_7 TAP)$$

$$y = \begin{cases} 1, & \text{Denial} \\ 0, & \text{Grant} \end{cases}$$

O: opponent

S: suggestion from other public agencies

T: type of variance (use variance, area variance)

A: property area

V: land value

TP: existing type of property (residential, commercial, mixed use, other)

TAP: type of variance applicant (individual, firm, other).

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[5] Here conditional approval is categorized as grant.

Case Study Method

Case Study

The implementation of case studies is a widely used research strategy in social science research. Briefly defined, a case study "is an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984). A researcher may apply a single-case study or a cross-case study method based on the research questions. Cross-case studies can be used for generalizing commonalities. However, we should keep in mind that by using the case study method we cannot come to a universal conclusion, which is a noteworthy shortcoming of this technique. Single-case studies are not suitable for generalizing; however, they are suitable for testing general theories from multiple sources. In addition, based on findings about general causal effects from cross-case studies, the single-case method is used to study causal mechanism (Gerring, 2007).

This research applies single case-study method to analyze the influencing factors in zoning variance decision-making. Triangulation[6] is used as a justification of the propositions of hypotheses. Causal effects between independent variables and the final decision are apparent in existing literature. By using single-case study, this research initially tests the causal implications of existing general views about the influencing factors; second, this research digs into the causal mechanism. To what extent do these factors affect decision-making is one of the research questions. Furthermore, as a

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[6] Definition of triangulation: "the use of multiple sources and methods of gather similar information" (Byrne & Ragin, 2009, p. 343).

revelatory case study, it provides a new perspective on how other factors affect the

BZA's final decisions.

Study Area

Washington D.C. is the case study area in this research. The author chose this city

based on the considerations of the specialty and nonspecialty of this area.

First, Washington D.C. is one of the first cities which initialized comprehensive

zoning ordinances in the United States. Regulations on zoning and zoning variances

are highly developed. The related agencies are created for specific responsibilities and

have a specific framework and timeline in the procedure. In terms of the zoning variance

process, there is no apparent difference from other cities. This normative attribute

makes this city be representative of most other areas in the United States.

Second, Washington D.C. has a special attribute suitable for a study area in this

research. It is an old and highly developed city in regard to land use. The needs for

redevelopment occur throughout this city in recent years as the old buildings become

increasingly unsound in structure and irrelevant in function. It is appropriate to study the

trends related to variance application and decision. In addition, neighborhood

characteristics are distinctly different in terms of dwelling types, property values, historic

preservation, and household income. It is also an ideal place to study the social and

economic factors which might affect the BZA's decision-making spatially.

Figure 3-1 shows the conceptual framework of this paper.

<div align="center">

Data Collection and Data Processing

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Successful statistical analysis and geospatial analysis in this paper rely highly on

complete and reliable data sources. The author contacted the Office of Zoning and the

Office of Planning in Washington D.C. for compiled zoning variance applications. Both

have documented zoning orders, which are open to the public and can be accessed

through the official website of the Office of Zoning[7]. The documented zoning orders

include detailed information on each variance application, which contains applicant's

name, variances requested, property address, SSL (Square, Suffix, Lot)[8], hearing date,

decision date, property situation, applicant's testimony, recommendation from the OP,

the ANCs, and other public agencies, neighborhood's reaction, the BZA's decision, etc.

However, no effort has been made before to compile the aforementioned information

together. Although every case is unique in its conditions and variances requested, we

can record the main common variables of each case.

The author recorded 15 variables and a total number of 2140 cases from 1980 to

2009 according to the zoning orders provided online. All the data were saved in a table

in Microsoft Excel format. Some variables might not be used for the final analysis;

however, they were recorded in the original table for further reference. These 15

variables are as follows: zoning order number, hearing date, decision date, SSL, zone

district[9], type of property, type of applicant, variance requested[10], recommendation from

Office of Planning, recommendation from the ANCs, recommendation from other public

agencies, the opponents present at the public hearing, the BZA's decision, number of

votes, and community's reaction. Since the format of online documents was not

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[7] http://dcoz.dc.gov/search/search_orders.asp
[8] SSL is a coding method to identify property in Washington D.C. In most cases, SSL is corresponded to one single address. However, it also has "a many to many relationship. One SSL (Square, Suffix, Lot) can have multiple addresses located on it. This often includes garden style apartment complexes as well as corner addresses with separate addresses facing each adjacent street. One address can also sit upon multiple properties, and one single family residence can sit upon multiple lots. The address records only contain one 'base' SSL (usually comes from OwnerPly)" (District of Columbia Office of the Chief Technology Officer, 2009). For the cases which had more than one SSL, the author recorded the first SSL shown in the document to geocode the properties' locations.
[9] Zone district means "sections of the District of Columbia delineated on the zoning map for which the regulations governing the use of land and the use, density, bulk, and height of buildings and other structures are the same" ("Zoning Regulations," 1958, p. 3).
[10] A table in Appendix B shows detailed information on variance requested, compiled by the author.

standardized before 2002, information on variables could not be found in some cases. The value was recorded as "NA" to represent the above situation.

Spatial data were compiled and created for geospatial analysis. There are two ways to geocode the location of properties in this research. The first way is to record the addresses of properties and purchase the geocoding service to geocode these data. Providers of geocoding services such as Geocoder, EZ-locate, and Maponics, can be found on the internet. The second way is to relate the Excel table to existing shapefile. Since we do not have available address lists for all the applications, more time was expended to record all the addresses. Besides, purchasing online services are more costly. Since some shapefiles containing the information of SSL are available on the D.C. government website, we can connect the Excel table to these shapefiles and configure the shapefile to indicate the location of variances. The owner point shapefile, record lot[11] shapefile, and tax lot[12] shapefile can be used for connection.

The owner point shapefile is supposed to contain all the properties in Washington D.C. The author first connected the table with these three shapefiles separately, but later found a great amount of cases which could not be found in the above three shapfiles. The failure of connection stems from the subdivision of record lot/tax lot.

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[11] Record lots "are defined by the Department of Consumer of Regulatory Affairs (DCRA) – Office of the Surveyor (OS) - DC Surveyor. They are official, platted, recorded subdivision lots created by the D.C Surveyor's Office in compliance with the Subdivision Ordinance of the District of Columbia (must have public street frontage etc)… in most case scenario's, a piece of property must be a Record Lot before a building permit will be issued for that site in the District of Columbia, and all proposed Record Lots are carefully reviewed by Zoning Administration officials for compliance with the city's Zoning Ordinances… Record lots are defined only when requested by property owners, normally when they are seeking a building permit" (District of Columbia Office of the Chief Technology Officer, 2008).

[12] Tax lots "are strictly for real estate taxation purposes… RPTA normally defines tax lots under two circumstances: 1) when property owners ask for their real property tax bills to be consolidated, after they have bought several contiguous record lots; this is called a combine; 2) when part of a record lot is sold, but no new record lot is yet defined; this is called a split request. Tax Lots are not normally acceptable when applying for building permits and must be converted to Record Lots through the normal subdivision process involving the D.C. Surveyor's Office before permits will be issued. The only exception is if the lot does not face a public street" (District of Columbia Office of the Chief Technology Officer, 2008).

Some lots were subdivided and new SSLs were allotted to the newly subdivided lots. SSLs for the old lots do not exist anymore. Another explanation is that some data were not simply recorded in the shapfiles. In order to geocode all the cases, the author took five steps to finish geocoding process.

Step 1 connects SSL in the variance table (Excel format) with SSL in owner point table (ArcGIS format). 1408 cases were matched, in which 98 locations evinced at least two variance requests. A new shapefile was created named ownerpt_match. This shapefile contains geospatial location, owner information and variance information.

In step 2 some SSLs in the owner point shapefile are also included in record lot shapefile. In the case of overlap happens, the author first deleted the matched 1408 cases in the variance table and then connected the left cases with record lot shapefile. 152 cases were matched in this step, in which 11 locations met variance requests twice or more. Since the record lot shapefile is a polygon file, we must convert it into a point file so as to be consistent with the owner point shapefile. A new point shapefile named recordlot_match was created, which contains geospatial information, record lot information and variance information.

Step 3 applies the same process in Step 2 to tax lot shapefile. Two cases were matched and a new shapefile was created called taxlot_match. After this step was done, 1562 cases were matched, while 578 cases were left unmatched.

In step 4 the US addresses of the unmatched 578 cases were input into an ITouchMap13 coordinate converter and to obtain the latitude and longitude of all the 578 properties. ArcGIS functions to locate points according to their latitude and longitude. A new shapefile named other_match was then created.

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[13] http://itouchmap.com/latlong.html

Step 5 combines ownerpt_match, recordlot_match, taxlot_match and other_match into one shapefile and names it "variances_full". All the variance application cases are geocoded in ArcGIS.
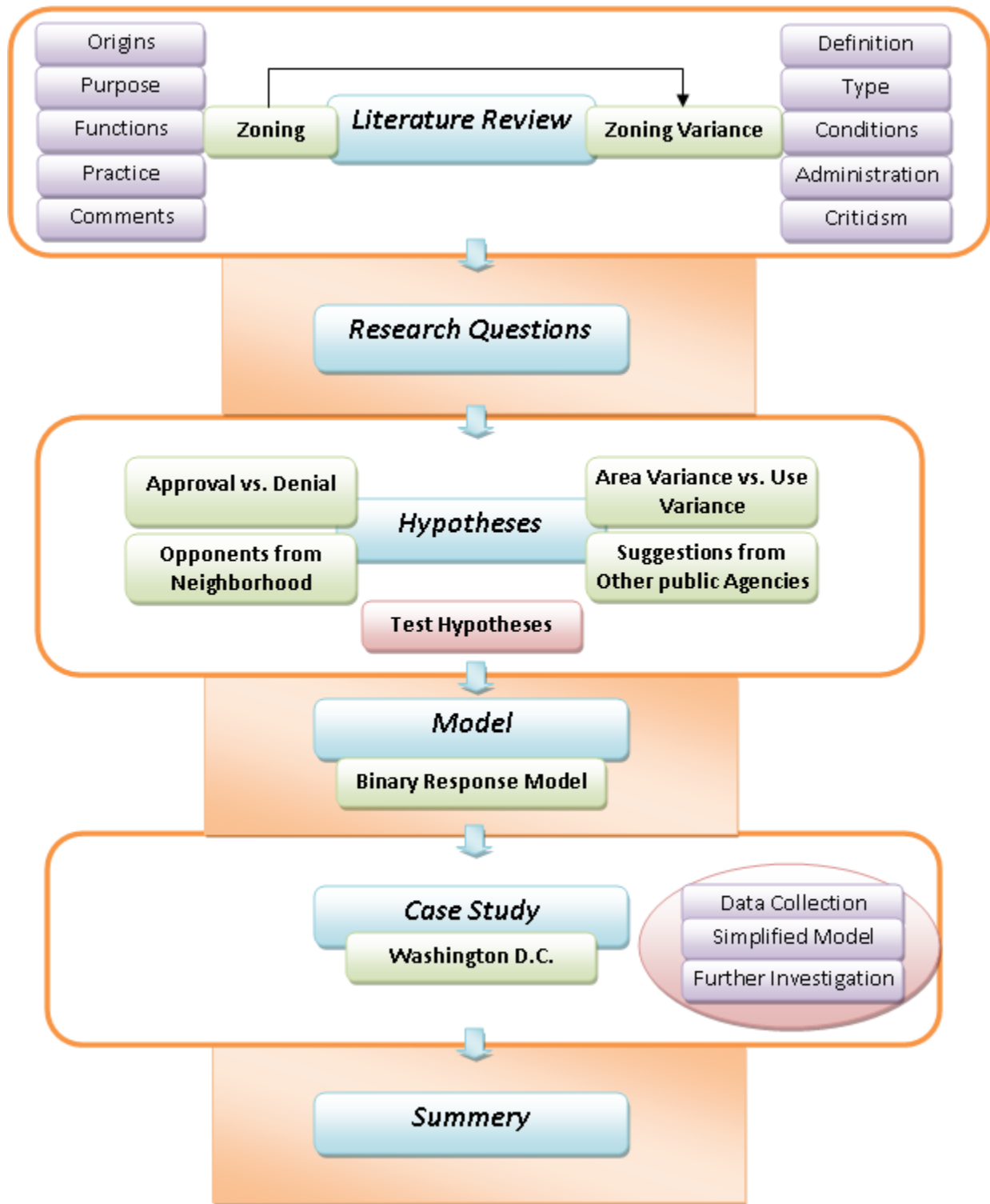
Figure 3-1. Conceptual Framework of this Paper

CHAPTER 4
CASE STUDY—WASHINGTON, D.C.

Introduction of Washington, D.C.

Washington, D.C. has been the capital of the United States since 1790. As one of

the nation's largest metropolitan cities, it is also a political and cultural center. It is a

typical example of a mix of both old and new elements, has good communities, historic

architecture, modern service, and great parks and waterfront. More than 20 million

visitors visit D.C. each year for cultural, commercial, and political exchange. "The

District is unique in that it operates simultaneously as a city, a state, and as the seat of

federal government" (District of Columbia Office of Planning, 2007, p. 2).

The District is located in the mid-Atlantic region of the United States, which is

bordered by the states of Virginia and Maryland. The boundary lines are straight and

Potomac River is a natural boundary on the one side (Figure 4-1). The total area of the

District is 68.5 square miles. The population now is around 0.6 million, of which 40.1%

are white, 50.4% are black and 9.5% are others. In recent years, the population has

grown at an average rate of 0.39% since 2003. The median household income is

$58,553 in 2008[1].

City Planning in Washington D.C.

In Washington, D.C., the L'Enfant and McMillan plans are benchmarks in the

history of planning. The L'Enfant plan in 1791 was the "first and most comprehensive

plan ever designed for any city" (Caemmerer, 1939). The new national capital was

designed under this plan, including the District's diagonal and grid system, street design,

parks, as well as the Capitol and the White House. Influenced by City Beautiful

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[1] Source: U.S. Census Bureau

Movement, the McMillan plan endeavored to develop the park system in the District, which focused on the open space of the National Mall, and neighborhood parks (District of Columbia Office of Planning, 2007). These two plans paved the road to further design and improvement of the District in the following century.

In 1950, the first Comprehensive Plan was produced by the National Capital Park and Planning Commission (NCPC), which was created in 1924. The Comprehensive Plan is a guideline for the future land use and development for a long time frame. This plan put significant efforts toward housing and transportation. In 1961 and 1967, another two Comprehensive Plans were established by the NCPC, including landscape change, expansion of central business district, and other urban renewal projects (District of Columbia Office of Planning , 2007). In 1973, the District of Columbia Home Rule Act was passed, which divided the Comprehensive Plan into the District's elements and the Federal elements. The former are prepared by the District's Office of Planning under the administration of the Mayor; the latter are prepared by the NCPC.

> The Mayor shall be the central planning agency for the District. He shall be responsible for the coordination of planning activities of the municipal government and the preparation and implementation of the District's elements of the comprehensive plan for the National Capital which may include land use elements, urban renewal and redevelopment elements, a multi-year program of municipal public works for the District, and physical, social, economic, transportation, and population elements. (Office of the General Counsel, 1973, sec. 423)

The first new Comprehensive Plan under this Act was adopted in 1984 and was amended periodically as needed. The 1989 and 1994 amendments added Ward Plans[2]. The most recent 2006 Comprehensive Plan, which was amended in 2009, includes 13 citywide elements and 10 area elements. The citywide elements are:

- Land use
- Transportation
- Housing
- Economic development
- Parks, recreation, and open space
- Educational Facilities
- Environmental protection
- Infrastructure
- Urban Design
- Historic Preservation
- Community services and facilities
- Arts and culture
- Implementation

The 10 area elements contain:

- Capitol Hill
- Central Washington
- Far Northeast and Southeast
- Far Southeast and Southwest
- Lower Anacostia Waterfront and Near Southwest
- Mid-City
- Near Northwest
- Rock Creek East
- Rock Creek West

[2] "Ward Plans are designed to interpret and apply those objectives of the Comprehensive Plan as appropriate for each of the eight legally defined geographic areas of the city" (District of Columbia Office of Planning, 2007).
Wards "are political subdivisions of the District, created for the purpose of voting and representation…Wards as they exist today were first created in the District in 1968 to implement congressional legislation authorizing election of members to the District of Columbia Board of Education…In accordance with a Supreme Court ruling that requires equal representation, the District government redraws ward boundaries after each decennial census, if necessary, to ensure that ward populations are as near to equal size as possible. When boundary changes were made in 1982, the Office of Planning prepared the preliminary ward boundaries, as closely to natural neighborhood boundaries, to equalize the population among the wards…The boundaries of the wards have been redrawn four times, after the 1970, 1980, 1990 and 2000 censuses" (District of Columbia Office of Planning, 2007, p. 27).

- Upper Northeast[3]

The Wards Plans were replaced with area elements in 2006 Comprehensive Plan. Yet in practice, some planners and scholars still use Wards for geographic divisions in the District due to its long history of application.

Zoning in Washington D.C.

History of Zoning

As early as the establishment of Washington, D.C., President Washington proclaimed a height restriction of 40 feet on new buildings. In 1910, a comprehensive height regulation was established (Caemmerer, 1939). It could be seen as the early formation of the conception of zoning. The District initialized the first comprehensive zoning ordinance, the Zoning Act of 1920, right after the first comprehensive zoning ordinance was enacted in 1916 in New York City. Types of use districts, height, and lot occupancy were regulated in this ordinance, which can be seen in three separate maps. The Zoning Commission was established and its basic structure was formed. The Zoning Act of 1938 was an extension and clarification of the Zoning Act of 1920. This Act established the police power of the Zoning Commission and its responsibility. The Board of Zoning Adjustment (BZA) was also created in the Zoning Act of 1938. In the 1950s, a Comprehensive Plan suggested completed revisions on the zoning regulation map and text. In addition, suggestions regarding commercial zoning, off-street parking and loading, and some other detailed issues were proposed. The Zoning Ordinance of 1958 adopted most suggestions from the Lewis Plan of 1958[4], in which Harold Lewis, who was one of "the Nation's foremost city planners" and consultants (Peel, 1939, p.

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[3] (District of Columbia Office of Planning, 2007)
[4] Harold MacLean Lewis, A new zoning plan for the District of Columbia - final report of the rezoning study, 1956, New York

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158), suggested "a major zoning overhaul" (Kress, 2001, p. 2), including the BZA's responsibility, unification between zoning districts and comprehensive planning, a floor area ratio system, parking restrictions, etc. The Zoning Ordinance of 1958 is still the guidance document for the Zoning Commission and the BZA. In 1990, the Office of Zoning was created according to the Office of Zoning Independence Act of 1990 to assist the Zoning Commission and the BZA (Kress, 2001).

Zoning Regulations and Administration

Zoning regulations in Washington, D.C. are indispensible as a component of the municipal regulations. Several public agencies are involved in the administration of zoning regulations.

> Zoning regulations are set forth in Title 11 of the District of Columbia Municipal Regulations and the accompanying zoning maps. Zoning authority is exercised by the Zoning Commission of the District of Columbia and the District of Columbia Board of Zoning Adjustment. The Home Rule Act requires that zoning not be inconsistent with the Comprehensive Plan. (District of Columbia Office of Planning, 2007, p. 25)

Currently, the District has 34 zoning districts and 27 overlay districts. The zoning districts, which are basic divisions, refer to the different use of districts. Overlay districts could be combined with zoning districts to add special regulations onto the existing zoning districts. The zoning districts are divided into six categories:

- Residence District
- Special Purpose Districts
- Mixed Use Districts (commercial, residential)
- Commercial Districts
- Industrial Districts
- Waterfront Districts

In addition, there were subcategories in some of above categories. The overlay districts, which have the same structure with the zoning districts, have 11 categories and some subcategories. These categories are:

- Langdon Overlay District
- Mixed Use Diplomatic Overlay District
- Hotel-Residential Incentive Overlay District
- Capitol Interest Overlay District
- Neighborhood Commercial Overlay Districts
- Reed-Cooke Overlay District
- Miscellaneous Overlay Districts
- Downtown Development Overlay District
- Uptown Art-Mixed Use Overlay District
- Capitol Gateway Overlay District
- Southeast Federal Center Overlay District.

There are four main public agencies involved in the zoning regulation and administration. They are:

- Office of Zoning (OZ)
- Office of Planning (OP)
- Advisory Neighborhood Commissions (ANCs)
- Zoning Administrator (ZA)[5].

Inside the OZ, there are two important agencies set up to exercise zoning authority: the Zoning Commission (ZC), and the Board of Zoning Adjustment (BZA).

Table 4-1 lists each agency's functions.

Zoning Variance in Washington D.C.

Regulation of Zoning Variance

Zoning ordinance in Washington D.C. recognizes both area and use variance. It also recognizes two standards for "peculiar and exceptional practical difficulties" or "exceptional and undue hardship"[6] in its regulation and in administration.

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[5] Zoning Administrator is inside Department of Consumer & Regulatory Affairs (DCRA).

Under § 8 of the Zoning Act, the D.C. Official Code § 6-641.07(g) (3) (2001),

provides that the BZA may approve the zoning variance application:

> [W]here, by reason of exceptional narrowness, shallowness, or shape of a
>
> specific piece of property at the time of the original adoption of the regulations, or
>
> by reason of exceptional topographical conditions or other extraordinary or
>
> exceptional situation or condition of a specific piece of property, the strict
>
> application of any regulation adopted under D.C. Official Code §§ 6-641.01 to 6-
>
> 651.02 would result in peculiar and exceptional practical difficulties to or
>
> exceptional and undue hardship upon the owner of the property, to authorize,
>
> upon an appeal relating to the property, a variance from the strict application so
>
> as to relieve the difficulties or hardship; provided, that the relief can be granted
>
> without substantial detriment to the public good and without substantially
>
> impairing the intent, purpose, and integrity of the zone plan as embodied in the
>
> Zoning Regulations and Map.[7]

Form 121 Applicant's Burden of Proof for Variance and Variance Special

Exception Applications establishes two categories of variances: area and use. These

variance types are defined as follows:

> An area variance is needed when the owner wishes to make some change to the
>
> physical structure or lot itself and the property does not or will not comply with the
>
> Zoning Regulations in some respect. A use variance is needed when the owner
>
> wishes to use the property in a way that is not permitted in that zone district

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[6] Source: 11 DCMR § 3103.2.
[7] See also 11 DCMR § 3103.2

under the Zoning Regulations. (District of Columbia office of zoning, 2008, para. 1)

Three criteria[8] must be met for the grant of a use or area variance:

1. Are there peculiar and exceptional, practical difficulties, such as the property is exceptionally narrow, shallow, oddly shaped, and/or has unusual topography, soil conditions, or other special conditions:

a. What makes it difficult for the owner to build on the property in compliance with the Zoning Regulations? (area variance)

b. How will there be financial hardship for the owner in using the property consistent with the Zoning Regulations? (use variance)

2. Granting the application will not be of substantial detriment to the public good; and

3. Granting the application will not be inconsistent with the general intent and purpose of the Zoning Regulations. (Kress, 2001, p. 33)

The board applies the interpretation stated by the D.C. Court of Appeals case of Palmer v. Board of Zoning Adjustment, 287 A.2d 535, 539 (D.C. 1972) to testify the proof of practical difficulties and undue hardship. "'exceptional and undue hardship' should be construed to require a showing of a situation where in the absence of a variance of the property cannot be reasonably used in a manner consistent with the Zoning Regulations" (District of Columbia Court of Appeals, 1972, para. 43). As for

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[8] See also the court's clarification about the tests in the case Washington Canoe Club v. District of Columbia Zoning Commission: "[i]n order to obtain variance relief, an applicant must show that (1) there is an extraordinary or exceptional condition affecting the property; (2) practical difficulties will occur if the zoning regulations are strictly enforced; and (3) the requested relief can be granted without substantial detriment to the public good and without substantially impairing the intent, purpose, and integrity of the zone plan" (para. 12).

"practical difficulties", though there is not clear definition, the court pointed out "it must be shown that compliance with the area restriction would be unnecessarily burdensome" (para. 67). The courts have clarified the tests for area variance and use variance. In Palmer, the court opined that "area variances have been allowed on proof of practical difficulty only while use variances require proof of hardship, a somewhat greater burden" (para. 45). The court agreed that "a more stringent showing is warranted with respect to the more drastic relief inherent in a use variance" (para. 50). On the basis of the difference between "practical difficulties" and "undue hardship", the D.C. circuit made it clear that "practical difficulties" is applied to the criterion of an area variance and "undue hardship" is applied as the criterion of use variance.

In regard to a use variance, the ordinance allows consideration of "financial hardship". Traditionally, financial hardship is not considered to be undue hardship or unnecessary difficulties in most states. An applicant "is not entitled to the best and highest use of the land or maximum benefit from the parcel" ("Replacing the Hardship," 1987, p. 682). It was almost unanimously confirmed by courts that "mere financial hardship or an increased return from the property is not a sufficient reason for granting a variance" ("Administrative Discretion in Zoning," 1969; Cohen, 1995; "Zoning Variances," 1961; "Zoning Variances and," 1955, p. 520). "Financial disappointment alone, including loss of profits or prohibition of the most profitable use of the property, will not justify a variance" (Jacobs, 1958, p. 822).

In the case Palmer v. Board of Zoning Adjustment, it was recognized by the court that "it is certain that a variance cannot be granted where property conforming to the regulations will produce a reasonable income but, if put to another use, will yield a

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greater return…An inability to put property to a more profitable use or loss of economic advantage is not sufficient to constitute hardship" (District of Columbia Court of Appeals, 1972, para. 67). I looked through zoning orders in Washington D.C. and listed the following cases which are representative of the attitude of the BZA towards financial hardship. In application No. 11000 when the applicant proposed a nursing home in the R-1-B district, the board demonstrated "this Board has held in the past and continues to hold that economic and financial potential gain or loss will not alone substantiate relief from the strict interpretation of the regulations" (District of Columbia Office of Zoning, 1974, p. 4). In the case of application No. 14019 the applicant pursued a use variance for all day commuter parking and the application was granted. The board confirmed that, "The Board concludes that there is no other reasonable interim use of the subject property than the continuation of the subject parking facility" (District of Columbia Office of Zoning, 1983, p. 3). In the case of application No. 11511, the applicant proposed to use the property as a flat in the R-3 zone and claimed that "strict application of the Zoning Regulations would cause an economic loss to her by reason of her large financial expenditure in purchasing this property thinking, that it could be used as a flat" (District of Columbia Office of Zoning, 1974, p. 3). The BZA pointed out the misconception about the status of the property by the applicant before she purchased the property could not be the proof of financial hardship. The board denied her application. In the case of application No. 11925, the applicant asked for a use variance to provide a social service center in R-3 district. The BZA concluded "economic hardship or financial inability to develop property is not a basis for hardship as claimed by applicant, unless that economic burden is caused by topography or other exceptional

circumstances" (District of Columbia Office of Zoning, 1975, p. 3) and denied the

application. The applicants in the case of No. 13405 alleged financial difficulties and

asked for a lot area variance. The board denied their application stating that "the

financial difficulties alleged by the application are personal and are not derived out of

the property itself" (District of Columbia Office of Zoning, 1981, p. 3). According to the

cases and decisions above, financial hardship is based on the property itself rather than

circumstances pertaining to the owner. It should be caused by topographic or other

exceptional circumstances. Strict observance of zoning ordinance would lead to

financial infeasibility of the property. The conception about financial hardship in

Washington D.C. is consistent with other states/cities which allow financial hardship as

the reason of applying for zoning variance.

Zoning Variance Procedure

The variance application process usually takes around four months since the

applicant submits an application to the OZ until the Final Order is received by the

applicant. In reality, the applicant first applies for a Building Permit to DCRA and then

ZA determines whether this application is allowed by zoning ordinance. If a variance

application is needed, ZA provides the applicant with advice. The applicant prepares

and submits variance application to OZ. Once OZ confirms the required application is

complete, OZ schedules a public hearing before the BZA. In addition, the application is

forwarded to the OP, the ANCs, property owners within 200 foot, and other DC

agencies for review. The hearing data are then published in the DC Register.

Meanwhile, the applicant must post placards on the site as a notice to the neighborhood.

The OP is required to submit a report with recommendations after the OP staff meet

and discuss the proposal with the applicant. The BZA is required under D.C. Code § 6-

623.04 (2001 Ed.) to give "great weight"[9] to the OP's recommendation. The BZA is also

required under D.C. Code § 1-309.10 (d) (2001 Ed.) to give "great weight"[10] to the

ANCs' recommendations. The BZA conducts a public hearing. ZC may announce the

decision following the hearing or at a subsequent meeting. ZC approves the Final Order,

which is then published in the DC Register and made available on the OZ website.

Finally, the Final Order is sent to the applicant. Figure 4-2 shows the flow chart of

zoning variance process in Washington, D.C.

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[9] D.C. Official Code § 6-623.04 (2001 Ed.) provides "Office of Zoning--Recommendations, reports, review and comment by Office of Planning…Nothing in this part shall be construed to prevent the Office of Planning from continuing to provide recommendations and reports to the Zoning Commission and the Board of Zoning Adjustment on any zoning case. The Office of Planning shall review and comment upon all zoning cases, and the Zoning Commission and the Board of Zoning Adjustment shall give great weight to the recommendation of the Office of Planning. Upon request of the Zoning Commission or the Board of Zoning Adjustment, the Office of Planning shall provide recommendations, information, or technical assistance in a timely manner."

[10] D.C. Official Code § 1-309.10 (d) (2001 Ed.) provides "The issues and concerns raised in the recommendations of the Commission shall be given great weight during the deliberations by the government entity. Great weight requires acknowledgement of the Commission as the source of the recommendations and explicit reference to each of the Commission's issues and concerns."
"Under § 3 of the Comprehensive Advisory Neighborhood Commissions Reform Act of 2000, effective June 27, 2000 (D.C. Law 13-135, 47 DCR 5519 (2000)) (to be codified at D.C. Code § 1-261(d) (3)(a)), the Board must articulate with particularity and precision the reasons why the ANC does or does not offer persuasive advice under the circumstances and make specific findings and conclusions with respect to each of the ANC's issues and concerns. The Board carefully considered both the OP and ANC reports and, as explained in this decision, finds their recommendations to grant the application persuasive. The Board also incorporated the conditions recommended by the ANC in this order" (District of Columbia Office of Zoning, 2001).

Table 4-1. Overview of related zoning agency roles in Washington D.C.

Office of Zoning (OZ)
- Provides administrative support to the ZC and BZA, and serves as liaison to the OCC
  - Coordinates the zoning process with the OP and other agencies
  - Maintains and updates the Zoning Map and Zoning Regulations
  - Prepare public records for court cases
- Provides public information about the zoning process, the Zoning Regulations, the zoning of specific properties, and the status of pending applications
  - Keeps both bodies informed about matter affecting zoning

Zoning Commission (ZC) (within OZ)
- Prepare, adopt and amend the Zoning Map and Zoning Regulations

Board of Zoning Adjustment (BZA) (within OZ)
- Hear appeals of administrative decisions (interpretations) concerning the Zoning Regulations and Zoning Map
- Request for variance or special exception relief from said regulations

Office of Planning (OP)
  - Serves as the central planning agency for the District
- Provides public information about the zoning process, the Zoning Regulation, the Comprehensive Plan and other planning documents, District Wards and neighborhoods, and guidance concerning historic properties and districts
- Makes written recommendations on other zoning matters before the ZC and BZA
- Provides a coordinated District response by incorporating comments from other agencies into one report to the ZC or the BZA

Advisory Neighborhood Commissions (ANCs)
- Commissions are composed of elected residents that perform a formal citizen participation and review function at the community and neighborhood levels
- All zoning applicants to the ZC and BZA are referred to the appropriate ANC for review and comment
- In accordance with the ANC Act, ANC recommendations are given "great weight" by both bodies during deliberations

Zoning Administrator (within DCRA)
- Responsible for administrating and interpreting the Zoning Regulations and Zoning Map

Figure 4-1. Map of Washington D.C.[12]

Application
Applicant prepares and submits application to OZ

▷

Schedule
+OZ Staff schedules case for BZA Public Hearing

+Hearing date published in the DC Register

▷

Review
+Application sent to OP, ANC, property owners within 200 ft, and other DC agencies for review

+Applicant and OP staff typically meet to discuss request

▷

Notification
Applicant typically presents request to ANC, neighboring residents, and other affected agencies and posts notice of the hearing on the property

OP Recommendation
+OP submits report to BZA recommending approval or denial

+Report is due 7 days prior to the hearing and is published on the OP website

▷

Hearing
+BZA holds public hearing

+ZC may announce decision following the hearing or at a subsequent public meeting

▷

Final Order
+ZC approves final order, which is then published in the DC Register and made available on the OZ website

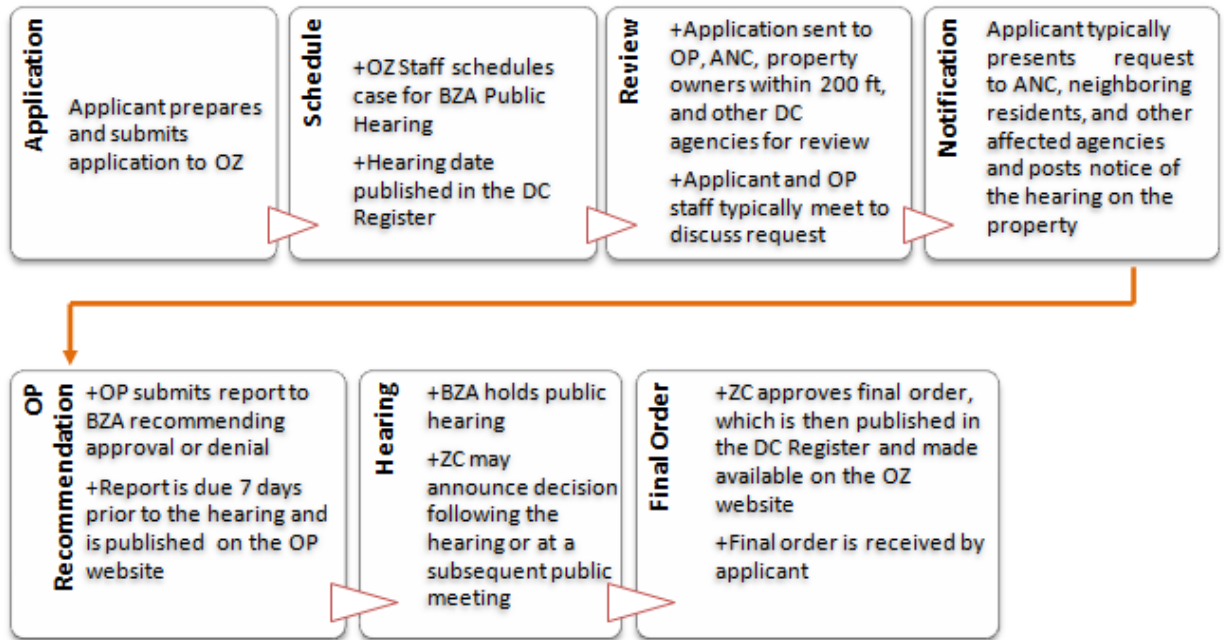+Final order is received by applicant

Figure 4-2. Zoning variance procedure in Washington D.C.[13]

[13] This graph was designed by the author and Lucy Elder when they had their internship on The District Office of Planning supervised by Travis Parker.

CHAPTER 5
ANALYSIS OF CASE STUDY FINDINGS

Zoning Variance Applications and Decisions – A General View

This study consists of a total of 2140 variance application cases from 1980 to 2009[1]. Since cases withdrawn[2] by the applicants or dismissed[3] by the board do not reflect the BZA decisions, they were not recorded in this study. Of the variance applications, 1824 (or 85.2%) requests were for area variances, and 316 (or 14.8%) requests were for use variances.

Variance Applications

Figure 5-1 shows the number of variance applications by type of variance and year. The number of variance applications hit a peak in 1980, 159 in total. Since the beginning of the 1990s the number of applications decreased to usually less than 60; while during the 1980s, the number of applications was usually more than 60. This decreasing trend in the early 1980s is in accordance with the economic recession lasting from 1980 to 1982. The energy crisis of 1979 led to inflation in the U.S., a situation halted by the government's decision to implement a tight monetary policy; the crisis culminated in domestic unemployment rates reaching 10.8% in 1982. Taking the hysteresis effect on economy into consideration, it is reasonable to explain the decreasing trend in variance application from 1980 to 1985. From 1990 to 1991, high oil prices led to yet another economic recession in the U.S. The decreasing number of variance applications since 1990 may be partly due to the economic downturn. In 1995,

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[1] Note: Data for 1985 for four months from May 15 to Sep. 25 are not available form Office of Zoning website.
[2] An applicant may withdraw his/her request without penalty. The applicant is not required to explain the reason of withdrawal.
[3] The failure to submit required materials or the failure to present in public hearing will lead to the dismissal of the request.

this number reached the lowest in 30 years with 28 applications in total. Area variance

applications were the main contributors each year; 74.5% to 97.1% of the total

applications each year. Use variance requests usually occupied less than 20% of the

total cases each year. In 1997, the number of use variances applications reached the

highest: 25.5%. In 2004, there were 2.9% use variance applications, the lowest during

the 30 year period. This graph shows the number of variance applications in recent

years were less than in the 1980s. It is uncertain to predict the future trend of variance

applications according to this graph. However, for more than ten years, from 1996 to

2009, the number of applications remained reasonably stable. The need for variances

appears to remain steady and evinces no sign of decline.

Decisions from the BZA

The final decisions from the BZA could be categorized in two simple results:

approval and denial. This two-choice decision outcome will be used later in the binary

response model analysis. Within those 30 years, a total of 1816 (or 85%) requests were

granted by the BZA- and 324 (or 15%) requests were denied. Consistent with other

studies in other cities, Washington D.C. shows a high approval rate of variance

applications (Figure 5-2). The average approval rate of variances was 84.9% since

1980. This approval rate was more than 70% each year, except in 1982. There were

two periods that the approval rates kept under 80%: from 1980 to 1983, and from 1992

to 1994. Since 1995, the approval rate remained above 80% each year; since 2005, the

approval rate exceeded 90% each year. Before 1995, the approval rate fluctuated, but

this situation changed since 1995- namely approval rate increased gradually since

1995.

When isolating area variances and use variances, the approval rate of the former was 87.9%; whereas the latter was 67.7%, or 20% lower than the rate of area variances. The approval rates of use variances were usually lower than area variances, ranging from 23.5% to 100%. It is apparent that the approval rates of use variances fluctuated more than those of area variances. A possible explanation for this difference in approval rates is that the number of use variances each year was relatively small. There are no clear trends of approval rate for either area variance or use variance. However, the chart (Figure 5-2) shows that the approval rates in recent years were more steady and higher than the rates of the 1980s. It is unknown why approval rates are so elevated. It could be that the BZA members tend to be lenient; or that other public agencies perform as filters which receive variance applicants and provide them with consultation before they pursue the next step of the zoning variance process; or perhaps applicants or their agents are simply prudent. The estimated variance application process itself takes around four months, not including the preliminary work done when the applicant submits an application. The burden of proof is largely on the applicant, so it is imperative that the applicant pursues a variance for which there is reasonable certainty of approval. Time, money and energy are considerations that often lead to prudent decisions.

Area Variance Approval

By examining the approved cases in depth, the requests can be grouped into three categories: full approval, conditional approval and partial approval. Full approval refers to the case in which all aspects of the pursued variance requests are approved without condition. The term "full" here has two meanings: the first meaning is that the BZA approves the proposal as submitted, and does not require additional conditions as the

premise of granting the variance; the second means that the BZA approves all the proposed variances. It is common that an applicant might propose several variances in one application. Conditional approval means that the BZA approves an application subject to some specific conditions. For example, in the case of Zoning Order 15605, applicants proposed the use of the first floor as an office space in a 2-story apartment building in a low density residential area. The BZA granted this application subject to the following five conditions: (1) the use shall be limited to the specifications in the application: apartment management office use and administrative offices for a tour company; (2) No exterior sign is allowed for the advertisement of these offices; (3) Number of employees shall not exceed four; (4) Commercial vehicles are not allowed to park on the site. (5) No loading or unloading shall be allowed on the site (District of Columbia Office of Zoning, 1992). Partial approval refers to cases, in which an application is granted partially. This can occur when the applicant has submitted at least two or more variance requests, and where the BZA denies at least one of the proposed variance requests.

Figure 5-3 shows the ratio of different approval types in the approved area variance cases by every five years. In most years the BZA gave full approval to the majority of the applications, which usually occupied more than 60% of the total approved cases, except in the period of 1985-1989. Conditional approval was the second largest category, which usually occupied more than 20% of the approved cases. Partial approval was rarely observed in the decisions. There were 9 cases identified as partial approval within this 30 year period, which represented 0.6% of all applications from 1980 through 2009. In the approved area variance application, the average full

approval rate was 70.1%, and the average conditional approval rate was 29.3% from 1980 through 2009. This diagram (Figure 5-3) shows that the proposals for area variance applications were more likely to be accepted fully. The high approval rate for applications, most receiving full approval, reflects that the BZA decisions on area variance applications were not as strict as prescribed by regulations.

Use Variance Approval

Figure 5-4 shows the use variance approval ratio for the approved applications by every five years. It demonstrates a different pattern compared to area variance approved applications. The percentage of use variance requests receiving conditional approval was usually more than 40%, considerably higher than that of area variances. The average conditional approval rate for the 30 year period was 49.5% of the use variances requests, and the average full approval rate was 50%. For the years 1980, 1981 and 2004, all the approved use variances were granted conditionally. This graph indicates that in granted cases, the BZA showed a more cautious attitude towards use variance cases than in area variance cases. The combination of a lower approval rate for use variance applications and a lower full approval rate for approved applications partially reflects similar findings by other scholars: the BZA is more reluctant to approve use variances than area variances. Additional analysis must be applied to verify whether this statement is accurate in terms of statistical significance. In Chapter 5 a statistical method was applied and the result revealed a significant difference.

From 1980 to 2009, the BZA gave 58% variance applications full approval, and 27% received conditional approval (Figure 5-5). There were 10 cases of partial approval. Although full approval constituted more than half of all applications, it should be noted that this does not entail that the original submissions were granted by the BZA without

any revisions. Before final submission to the BZA, applicants can engage the OP staff for policy explanations and other forms of guidance. Some original requests might be deleted or revised if there is suspicion that they would probably be denied. Some withdrawn and dismissed cases also have similar reasons, namely that applicants become aware that they lack proof to justify their burden after discussions with the OP staff or other public agencies.

When separating area variance requests with use variance requests, the final decisions are quite different. Area variance requests had a denial rate of 12% compared to 32% of use variance requests (Figure 5-6). These two pie charts show that use variance requests were more likely to be denied by the BZA, which is consistent with previous studies conducted by other scholars in other metropolitan regions. For area variance requests, 62% received full approval and 26% received conditional approval. For use variance requests, 34% received full approval and 34% obtained conditional approval. It shows that for use variance even the approved cases were less likely to be granted without conditions. One possible explanation is that the court requires a somewhat greater burden on use variance than area variance, as discussed in Chapter 4. In Washington D.C., an applicant for an area variance must prove the existence of practical difficulties. By contrast an applicant for a use variance must prove the existence of an undue hardship.

Of the 316 use variance applications, 203 (or 64.2%) were for commercial use. Since 7% of the property in Washington D.C. is commercial, there was a disproportionately higher application rate for use variances by commercial property owners (the percentage is shown in Figure 5-12). Of these 203 applications, 149 (or

90

73.4%) properties were located in residential zones. Of these 149 applications, 67 (or

45.0%) received conditional approval, and 77 (or 51.7%) were denied by the BZA. The

relative denial rate may reflect the recognition of the negative effects of use variances of

commercial properties in residential zones. On the other hand, the negative effects

brought about by the use variances of residential properties in residential zones or

commercial zones are likely to be viewed less adversely.

Since commercial activities in residential zones are not in accord with the primary

theme of zoning ordinances, they might cause more negative effects, resulting in the

BZA denial of applications or the placement of additional conditions on use variance

requests to restrict their adverse impact on residential neighborhoods.

Office of Planning Involvements

As mentioned in the section on Zoning Variance in Washington D.C. in this

chapter, the OP plays a very important role in providing recommendations, technical

support and offering other relevant information to the BZA[4]. It is required by law that the

BZA should give serious consideration to the OP recommendations. There is no

standard requirement for documenting the activities of the OP in the minutes of public

hearings and published the BZA orders. This author compiled all the cases from 1980

through 2009, and the results for the activities of the OP are shown in Figure 5-7. The

activities of the OP are divided into five categories: support, opposition, other, no action,

and NA. Support comprises full support, conditional support, and partial support.

Opposition means the OP recommends that the BZA deny the application. Other

signifies the submission of an OP report with concerns or recommendations with no

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[4] See also note 10 in Chapter 4.

clear stance. No action means it is recorded in the document that the OP did not prepare a report for submission to the BZA for reference. NA. indicates that the documents do not have information about whether the OP submitted a report or give suggestions to the BZA. During the period from 1980 to 2000, the majority of the documents did not record whether the OP submitted a report, or whether the applications were supported/opposed by the OP. This situation changed in 2001 when the recommendations of the OP were documented. In addition, the OP reports were clearer in terms of its stance; whether to support or oppose a variance request. Since 2005, the involvement rate of the OP was 100% each year. This graph shows that during the past decade, the OP's responsibility in variance cases, documentation of involvement and recommendations have become standardized. It was found in the year 2000 that the Office of Planning drafted a handbook for zoning planners: Zoning Application Processing. In this book, detailed explanations are provided about the zoning process and the timeline for zoning adjustment, variance, and special exceptions, which specify the OP's obligation and responsibility. This handbook is essentially a guide on the zoning process for the OP's internal use. Its issuance of this handbook could be the reason that in recent years, the OP involvement has both increased and standardized.

The ANCs' Involvements

The setting of the ANCs in Washington D.C. is a peculiar feature compared with other cities. They are formalized neighborhood associations, composed of elected residents from each neighborhood. The basic role of these immensely important bodies is to "consider a wide range of policies and programs affecting their neighborhoods, including traffic, parking, recreation, street improvements, liquor licenses, zoning,

economic development, police protection, sanitation and trash collection, and the District's annual budget."[5] As shown in the section on the Zoning Variance in Washington D.C. in Chapter 4, local regulations require the BZA to give serious consideration to the ANCs' recommendation during the decision making process[6]. The ANCs' involvement in zoning variance application decisions has two major advantages. First, it provides local residents with the opportunity to participate in governmental decisions, which helps to prevent abuse of power in the variance process. Secondly, compared to individual participation in public hearings, the ANCs' recommendation is relatively neutral, which represents the whole welfare of the local community. As shown in Figure 5-8, the ANCs' involvement has also increased gradually since 1980, from around 50% at the beginning of the 1980s to around 75% during the 2000s. Between 1980 and 2000, the involvement rates were higher than those of the OP. However, it is not reasonable to conclude the ANCs took more activities in the whole process during that period. Lack of standardized documentation might lead to inaccurate conclusions on OP and ANCs activities. Though the rate of "no action" has decreased considerably in recent years, the involvement of the ANCs is not been comparable to that of the OP since 2000. There were certain instances where no ANCs report was submitted to the BZA. Since 2001, the average rate of no action is still around 20%, which is more than that of the OP. The ANCs are established to "speak for" the non-political representatives of the whole community. The ANCs are composed of local residents in area neighborhoods, and are to ensure that the citizens' voices are heard in the political decision-making process. No action from an ANC indicates in some degree that there

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[5] Source: Website of the Office of Advisory Neighborhood Commissions.
http://www.dccouncil.washington.dc.us/officeoftheadvisoryneighborhoodcommissions
[6] See also note 11 in Chapter 4.

has been acquiescence to the applications. An OP report is more technical-oriented and

focuses on whether the request satisfies the criteria of variances. These reports

concentrate on neighborhood attitudes toward the application. Figure 5-8 shows that in

recent years ANCs involvement in variance requests has become actively supportive of

variance requests. Since the BZA places considerable weight on both OP and ANCs

recommendations, their high support rates might be one reason behind BZA's high

approval rate on zoning variance requests.

Community Involvement

Community involvement[7] refers to any party/person who attends public hearings,

or submits a letter or a petition to express his/her point of view, or represents an agent

in a public hearing. They can support, oppose, or express their concerns about

applications. During the period 1980 to 1984, the involvement rate was 60% or higher,

but then decreased (Figure 5-9). Since 1990, involvement rates have remained around

20%.

In the beginning of 2000, the term "party status"[8] was quoted in the documents.

Before that, there was no clear distinction for the level of community involvement in

terms of the number of persons involved. The new definition differentiates party from

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[7] The ANCs are excluded from community involvement here. The author separated ANC involvement from community involvement in this paper based on their different legal status and the stakeholders they represent. The ANC is a government body and its members are elected from local neighborhoods. It represents the whole neighborhood and makes decisions based on the benefits of their constituency. Community involvement refers to the activities of individuals or associations. Most of them are directly affected by persons whose properties are adjacent to the properties which have applied for a variance.
[8] "Party Status" gives the right to cross examine during hearings, call witnesses, and be notified by any actions by other parties. Those without party status can still testify at the public hearing(s) and submit comments. The granting of party status by the Zoning Commission is by no means certain; at a ZC PUD hearing several years ago, the Zoning Commission denied party status to the Capitol Hill Restoration Society, even though it exhibited the most expertise on the matter. http://www.ancnorm.org/wp-content/uploads/2011/01/Party-Status.pdf

person. In the "Form 140 – Party Status Request", an explanation is provided about person and party.

> Any person or representative of an organization may provide written and/or oral testimony at a public hearing. A person who desires to participate as a party in a proceeding, however, must make a request and must comply with the provisions on this form. A party has the right to cross-examine witnesses, submit proposed findings of fact and conclusions of law, receive a copy of the written decision of the Zoning Commission or Board of Zoning Adjustment, and exercise any other rights of parties as specified in the Zoning Regulations. Approval of party status is contingent upon the requester clearly demonstrating that his or her interest will be more significantly, distinctively, or uniquely affected by the proposed zoning action than that of other persons. (District of Columbia office of zoning, 2011, para. 1)

As mentioned in the literature review in Chapter 2, opponents or supporters should not affect the BZA's final decision. While Washington D.C. zoning ordinances do not include a party's opinion as testimony for the BZA decision making, the setting of party status indirectly reflects the BZA's consideration of the attended parties' testimony. In contrast to ANCs involvement, community involvement represents a certain party's interest over the whole neighborhood's interest. Usually the involved parties are owners and therefore commonly stakeholders with property adjacent to the applicant's property. They are naturally concerned with the possible negative changes that might affect their own properties. Neighborhood associations are also major participants in community involvement. When many neighbors oppose a variance application, it might urge the

existing neighborhood association might be urged to take measures in opposing the application.

In cases where the community is involved with variance applications, oppositions from individuals and associations, especially since 1990, constitute the majority (Figure 5-10). In the 1980s, 56.1% of applications were opposed by the community. In 1990s, the proportion of community involvement in all cases decreased, but the ratio of opposition increased to 77.7%. In the 2000s, this ratio averaged 72.4%. This phenomenon reflects that opponents were very motivated to attend public hearings or to write letters to express opposition to a variance request. On the other hand, no involvement from a community reflects its acquiescence to the proposals, though this cannot be misunderstood as tacit support. When a community does not get involved with a variance, it is assumed/surmised that the variance would not pose a significantly negative impact to the existing community.

Figure 5-11 shows the comparison among denial rate, the Office of Planning Opposition rate, the ANCs opposition rate and community opposition rate by year since 2000. As mentioned above, due to the problem of unstandardized documentation, the data about the OP involvement might not accurately describe the situation. Since the comparison would be biased using the data before 2000, this chart shows the comparison from 2000 to 2009. The chart clearly indicates that the denial rate is consistently lower than that community opposition rate. Community opposition rate kept more than 10% each year, while the denial rate was under 10%, except in 2002. In some years, the community opposition rate was twice or even triple the denial rate. Since 2003, the OP also shows a higher opposition rate than the BZA's denial rate. In

fact, during some years the OP opposition rate was higher than the community opposition rate. The ANCs opposition rate was generally small relative to the other groups and in some years was higher than the denial rate, in some years lower. It is difficult to visualize from this chart whether the BZA's denial on variance requests was affected by the OP, the ANC, or the community. In Chapter 5, a binary response model was applied to answer this question.

Table 5-1 provides the approval and denial rates under different recommendations from the Office of Planning, the ANCs, and communities. For the variance applications opposed by the OP, 62% were denied by the BZA and 38% were approved by the BZA. When the OP supported the applications, the BZA granted 93% of application requests and denied 7%. It implies that the OP support for variance requests considerably increased the probability of having a request granted. For cases in which the OP recommended denial, the BZA also denied a large proportion of the applications, but this relationship was not as strong as when a request received the OP support.

When the ANCs opposed applications, 43% were denied by the BZA with 57% receiving approval. When the ANCs supported the applications, 93% were approved and 7% were denied by the BZA, similar to the proportion supported by the OP. From these numbers it is evident that the attitudes of the ANCs towards variance applications appeared to influence both the approval rates and denial rates. The numbers also reflect that the ANCs' opposition has less influence on the BZA than that of the OP. In Chapter 5 the binary response model will show whether and to what extent the OP and the ANCs' recommendation affect the BZA's decisions.

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Regarding community activities, 67% of the applications were granted in cases when there were opponents, and 33% applications were denied. When there were supporters for the applications, 80% were granted and 20% were denied by the BZA. When the OP, the ANCs and neighbors all opposed the applications, 77% were denied by the BZA. When the OP, the ANCs and neighbors in the community all supported the applications, 98% were granted by the BZA. The consensus among the OP, the ANCs, and the community is more likely to influence the BZA to make the decision consistent with their recommendations.

Use of Properties Requested for Zoning Relief

According to the use of properties requested for zoning relief, the cases were grouped into five categories: residential, commercial, mixed use, industrial and other. Other refers to non-profit use, such as churches, non-profit office and community centers, etc. Figure 5-12 shows that residential use constituted 60% of the variance requests during the 30-year period. Commercial use made up 24% and ranked as the second largest use. Other accounted for 14% and mixed use was 2%. There were no industrial variance applications. Although eleven cases in total were in industrial zones, these uses were related to commercial, residential and mixed uses.

In terms of approval rate by property use, the approval cases were not evenly distributed. The highest approval rate was 17.7% higher than the lowest approval rate (Figure 5-13). Variance applications with mixed use were more likely to be granted, with an approval rate as high as 97.8%. "Other" use also had a high approval rate 91.3%. The approval probability for residential use was less than mixed use and other use. At 80.1% commercial use had the lowest approval rate. The supportive stance of the BZA to mixed use and other use is apparent. In the era of global warming and shortage of

energy in highly concentrated population centers, smart growth policy is widely accepted in Washington D.C. Planners typically promote stategies to make the community safer and healthier, as represented by community walkability, access to public transportation, and general convenience of living. Mixed-use development is one of those planning tools. Since this type of development is consistent with the theme of smart growth, the BZA is more likely to grant the application. Other refers to some non-profit uses which are set up for the public welfare. The effectiveness of these non-profit uses is demonstrated by the high percent of variance requests that are granted. Though differences existed in terms of approval rate by requested property use, the approval rates were still relatively high, regardless of the usage category of the requested property.

Figure 5-14 shows the number of variance applications by property use each year. Residential variance requests occupied the highest proportion each year. The gap between residential and other uses has declined in the later years. The number of residential variance applications by year shows the largest variation ranging from 16 to 101. The number of commercial variance applications decreased gradually from 1980 to 1989, and has remained under 20 since 1990, which ranged from 4 to 18. The number of other uses variance applications was more stable than other types of property use since the 1980s, with no more than 20 cases each year. Variance applications for mixed-use properties occupied a very small part each year. There were 14 years in which no variance application was proposed for mixed-use property. Five mixed-use applications were proposed during the 1980s, and 8 during the 1990s. Since 2000,

applications for mixed-use properties increased slightly, usually around 3 each year. In 2002, a maximum number of 8 was reached.

Approval rates might also show a discrepancy with regards to the type of applicant. This assumption comes from the concern that firms and non-profit organizations are more adept than individuals in preparing variance applications. Well-prepared variance applications are obviously more likely to be granted. Correspondingly, the variance requests of individuals are more likely to be rejected that those of firms and non-profit organizations. Table 5-2 shows how approval rates are different due to type of use and type of applicant. In general, individuals received the lowest approval rate, 79.8. Firms rank in the middle, with an approval rate of 88.9%. Other applicants received the highest rate, 93.9%. In terms of different types of property use, individual applicants met the strictest decisions when they applied for variances in which the type of property use was commercial or other. The approval rates for both are below 70%. Although in terms of residential variance applications, individuals received request approval as high as 82.9%, the approval rate for firms was 8.2% higher than that of individuals, which was 91.9%. "Other" performed the best, regardless of property use application.

Wards in Washington D.C.

As mentioned in Chapter 4, since 1968, wards[9] were applied to geographic divisions in Washington D.C. They were drawn based on natural neighborhood boundaries and redrawn according to the US Census population distribution. Each ward has an equalized population, which provides us with a standard to compare how zoning variance applications vary in the District in terms of number and geographic distribution.

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[9] See also note 31.

Figure 5-17 shows the distribution of variance applications by Ward. As this map shows, variance applications were highly concentrated in the middle of the city. Ward 2 had the largest number of variance applications, 561 or 26.2% of the total applications. Ward 6 had 459 applications, most of which were located in the north middle of the ward. Ward 3 ranked the third in terms of number of variance applications. However, the distribution of requested properties in this area was more diverse. Ward 4, Ward 7 and Ward 8 had the lowest number of applications, 152, 133 and 98 respectively. The number of applications in Ward 2 is five times more than that of Ward 8. Figure 5-16shows the distribution of approved and denied variance applications from 1980 to 2009. 1816 applications were approved and 324 were denied.

Ward 1

Ward 1 is the smallest ward within the eight wards, covering 1778 acres. As mentioned before, each ward has a similar population. It implies the density of population in Ward 1 is the highest among the eight wards, which has an average number of 41 persons per acre. Ward 1 is "predominantly residential, with 82% of its land area being used for housing" (District of Columbia Office of Planning, 2007, p. 33). The median household income was 36,902 dollars as of 2000, and the total number of housing units was 34,632. Mount Morgan and Columbia Heights are the two major neighborhoods in Ward 1. Lands for commercial use spread out along the major roads. To the south of Ward 1, there are a few lands for industrial use.

Figure 5-17 shows the distribution of variance applications and the BZA's decision. From 1980 to 2009, 236 (or 11.0%) variance requests happened in Ward 1, in which 147 were residential, 52 were commercial, 8 were mixed-use and 29 were other. In Ward 1, 32 (or 13.5%) applications out of 236 were denied by the BZA. As the graph

shows, variance applications spread out all over the Ward 1. Especially in the southern part boarding Ward 2, a relatively higher density is to be found; this area is part of the old city neighborhood.

Ward 2

Ward 2 is located in the center of the District and covers a variety of land use types. It is the busiest area in which the political, educational, historical, cultural and business activities concentrate. There were 39,352 housing units as of 2000, and the median household income was 44,742 dollar (District of Columbia Office of Planning, 2007). Ward 2 had 564 (or 27.6%) variance applications, the largest amount in the area. 72 (or 12.8%) cases out of 564 cases were denied by the BZA, which is 3.2% lower than the average denial rate of 15% for the District (Figure 5-5). Within the eight wards, Ward 2 was one of the most highly concentrated wards in terms of variance applications.

The White House, the Capitol, Washington Monument and a great number of museums are located in the middle of Ward 2, in which only a few variance requests were located. However, in the Central Business District (downtown) area, located in the north of the White House, variances requests were highly concentrated. The downtown area is the largest commercial area in the District and in terms of property use, a total number of 207 variance requests were for commercial use, which occupied 39.2% of the total number. It shows a majority of commercial variance requests happened in this area. 174 (or 83.6%) variance requests related to commercial use were approved, which was a little higher than the average approval rate 80.1% for commercial use (Figure 5-13).

Residential areas are located around the north, east and west of the downtown area. Desirable locations adjacent to the downtown area contribute to high property

values. "The recent trend toward urban living-occurring in cities across the United States – has made this area increasingly desirable and has contributed to higher home costs" (District of Columbia Office of Planning, 2007, p. 37). The Georgetown neighborhood is the traditional residential area, in which can be found Georgetown University, Dumbarton Oaks Park, Montrose Park, and Rock Creek Park are nearby. The average home value in Georgetown is much higher than other areas. Besides, Kalorama and Foggy Bottom are also traditional neighborhoods with high home values. New developments and redevelopments expand to east part of the old city neighborhood. From 1980 to 2009, 274 variance applications were related to residential use. It is apparent that the amount of variances applications and the distribution of variances are related to the activities of development. Mixed-use and other-use had 22 and 61 variance requests separately.

With the highest number of variance applications, Ward 2 can serve as a good study area for a deeper look into the eight wards.

Figure 5-19 shows the distribution of variance applications and the BZA's decisions by decennial periods. From 1980 to 1989 there were 293 (or 52.0%) out of 564 applications, more than half of the total applications during the 30 years. The BZA granted 249 requests, of which 133 were full approved and 116 approved on condition. 44 (or 15.0%) out of 293 requests were denied; 126 (or 43.0%) out of these were for commercial use, and 128 (or 43.7%) were for residential use. Variance requests during 1990 to 1999 were much less than those from 1980-1989. 119 (or 21.0%) out of 564 requests were proposed during this period. 18 (or 15.1%) cases were denied by the BZA. More than half of these requests were for residential use, and requests for

commercial use were 12 less than residential use. From 2000 to 2009 the amount of variance requests was 33 more than that of 1990-1999. Variances requests were highly concentrated in the east of Ward 2, which was in accordance with the increased development activities in the east part. 10 (or 6.6%) out of 152 cases were denied by the BZA. The denial rate here was much lower than the average denial rate. In addition, conditional approval rate was also much lower than before. Applications during 2000 to 2009 were more easily to be granted with full approval than before.

Ward 3

Ward 3 covers the west part of the District (Figure 5-20). The lands of this ward are mainly used for residential use. Low density residential properties are dominant in this area. More than 40% of the areas in Ward 3 are zoned as R-1 Districts (One-family detached dwellings). According to Census 2000, the total housing units numbered 38,734. It features the highest median household income, 71,875 dollars in 2000. There were fewer new residential developments in Ward 3 compared to other wards. New developments are mainly for mixed-use and concentrate around Metro stations Friendship Heights and Tenleytown Metro. Commercial properties are mainly clustered around Wisconsin Avenue NW and Connecticut Avenue NW.

From 1980 to 2009, there were 324 variance requests in Ward 3, in which 260 (or 80.2%) cases were of residential, 32 cases were commercial, 31 cases were other, and 1 case mixed-use. 33 cases out of 324 requests were use variances, in which 11 were denied. 17 out of 33 cases were related to commercial use in residential zones, 7 of which were denied by the BZA, 9 were granted with condition, and only 1 was granted with full approval. 6 use variance requests were related to non-profit use in residential zones, in which 1 case was denied. Seven use variance requests were related to

residential use in residential zones, which included the conversion or construction of apartment houses, or flats, in low density zones, the creation of an addition. Two requests proposing conversions into high density buildings were denied. Four requests were granted partially or with condition. One request was fully granted. The high denial rate of commercial use variance in residential zones shows that the BZA was very prudent in granting commercial use variance in these zones. As Figure 5-6 shows, the BZA seems less likely to grant use variance compared to area variance. From the above number, we can learn that the fewest grants were for those which proposed commercial use variance in residential zones.

Ward 4

Ward 4 is located in the north of the District and covers 5,763 acres (Figure 5-21). The whole area is dominant by residential land use, which is 87% of the total area. According to US Census 2000, Ward 4 had 31,044 housing units and 65% of the total housing units were single family housing. R-1 District (one-family detached dwellings) and R-2 District (one-family semi-detached dwellings) are the main zones in Ward 4, which cover around 50% of the total area. The median household income was 46,408 dollars, which ranked as the second highest household income in these 8 wards. Commercial use lands mainly spread along George Ave from the south to the north and Kennedy Street NW from the east to the west.

Most properties for variances applications were situated around the major roads of Ward 3. The total number of residential, commercial, other, and mixed use applications was 100, 19, 32 and 4 respectively. 34 (or 22.37%) out of 152 variance applications were denied by the BZA, which is much higher than the average denial rate of the District. This is especially true for commercial variance applications, 8 (or 42.1%) out of

19 applications were denied by the BZA. Besides, 13 (or 61.9%) out 21 use variance applications were denied. This statistic suggests that in the low residential density dominated areas, use variance applications are not easily granted.

Ward 5

Ward 5 is situated in the northeast of the District (Figure 5-22). It is the most diverse region in terms of land use, which includes residential, commercial and industrial areas. Lots for commercial and industrial uses are concentrated and relatively large. Low density residential zones are mainly located to the northeast of the ward. In the south and southeast are mainly high density residential zones. In 2000, the total housing units numbered 32,258 and the median household income was 34,433 dollars.

175 variance applications were for properties situated in Ward 5, in which 103 were for residential use, 39 for commercial use and 33 for other use. 44 (or 25.1%) out of 175 applications were denied. In the southeast and the middle of the ward variances applications tended to be concentrated. As shown in the southeast of the ward, 4 applications with adjacent properties were denied by the BZA. They were all for use variance and the properties are located in residential zones. All 4 variances applied for commercial use in residential areas. Economic benefits drive property owners to change the use of property, especially when existing commercial properties are nearby. However, as pointed out in Chapter 4, "mere financial hardship or an increased return from the property is not a sufficient reason for granting a variance" ("Zoning Variances and," 1955, p. 520). Unless a large scale rezoning plan is proposed for local economic development by a great number of residents, city planners, and local policy makers, there is no sufficient reason to transform the use of property from commercial to residential just for financial considerations.

Ward 6

Ward 6 is in the heart of the District (Figure 5-23). The natural boundary of the Anacostia River separates Ward 5 from Ward 8. The northwest of the ward is featured as available for commercial use and mixed use; the area is connected to the downtown area in Ward 2. In the south around the Navy Yard, the land use is also for commercial and mixed uses. The northeast part is covered with residential lands, which are mainly R-4 Districts (row dwellings, conversions, and apartments). Much of R-4 District "would lie within urban renewal areas as assigned by the Redevelopment Land Agency, the demolition of substandard structures and replacement with low density apartment houses should be encouraged" ("Zoning Regulations," 1958, p. 12). The total housing units were 35,510 and median household income was 41554 according to US Census 2000. Affected by the new urbanism, urban renewal is described as smart growth, mixed-use and transit oriented development. Blighted communities are gradually transformed through mixed use of retail, office, and residential.

Redevelopment also brought a large number of variance applications. From 1980 to 2009, there were 459 variance requests in Ward 6, in which 233 were proposed during 1980s, 112 were proposed during 1990s, and 114 were proposed during 2000s. 252 (or 54.9%) out of 459 requests were for residential use, 142 (or 30.9%) were intended for commercial use, 55 (or 12.0%) were for other use, and 10 (or 2.2%) were for mixed use. All these 10 requests for mixed-use were approved by the BZA. 62 (or 13.5%) out of 459 requests were denied. This denial rate was less than the average denial rate of the District. It might reflect that the BZA was less strict when large scale redevelopment occurred for the revitalization of local communities.

Ward 7

Ward 7 is situated in the east of the District (Figure 5-24). 1/4 of the ward's area belongs to federal government, most of which is park land. Using Fort Dupont Park as a divider, R-1 Districts (one-family detached dwellings) are mainly concentrated in the south of the ward. R-2 Districts (one-family semi-detached dwellings) and R-5 Districts (general residence) are mixed together in the north of the ward. According to US Census 2000, the total housing units numbered 33,651; and the median household income was 30,533 dollars, which was the second lowest income within the 8 wards. Around 97% of the population in Ward 7 were black, 2% were white, and 1% were other. The commercial land in the middle west of the ward constitutes the Minnesota/Benning Business District, which includes large shopping centers, retail stores and other services. According to the handbook prepared by Office of Planning, this business district was not fully utilized; parts of the area "consist of empty parking lots, open storage, vacant buildings, and undeveloped land" (District of Columbia Office of Planning, 2007, p. 53).

From 1980 to 2009, a total number of 133 variance applications were proposed in Ward 7, in which 92 (or 69.2%) were for residential use, 16 (or 12.0%) were for commercial use, and 25 (or 18.8%) were for other use. Unlike Ward 2, more than a half of the applications were proposed during 2000 to 2009. Comparable to the rank of median household income, the total amount of variance applications ranked the second lowest within the 8 wards. It might reflect that the number of variance applications is related to the local economic activities and situation. 20 (or 15.0%) out of 133 applications were denied by the BZA, in which 13 were intended for residential use, 4 for commercial, and 3 for other. 19 out of 133 applications were use variances, in which

8 (or 42.1%) were denied. Compared to 32%, the average denial rate of use variance, the rate was much higher in Ward 7.

Ward 8

Divided by Potomac River, Ward 8 is located in the south of the District (Figure 5-25). It is the largest ward within the 8 wards, which covers 7,556 acres; however, the taxable area is only 962 acres. Public and Institutional land, park land and water bodies occupy the most part of this ward. According to US Census 2000, the total housing units were 29654 and the median household income was 25,017 dollars, both of which ranked the lowest within the 8 wards. The residential land in Ward 8 is mainly occupied by multi-family units, which was around 70% of the total housing units. The homeownership rate was around 20% in 2000, which was much less than the average homeownership rate: 40% in Washington D.C. Encouraged by housing projects and financial assistance programs, this area is under large scale development and redevelopment since 2000. From 2000 to 2005, around 8,000 housing units were constructed or rehabilitated (District of Columbia Office of Planning, 2007). Residential developments also brought parallel developments to commercial and public services.

The total amount of variance applications from 1980 to 2009 was 97, much less than other wards. 63 (or 64.9%) requests were proposed from 2000 to 2009, which was in accordance with the large scale development and redevelopment activities since 2000 in Ward 8. Although the total number of requests was not as many as other wards, developers might apply for Planned Unit Developments (PUD) for more flexibility, which is not strictly constrained by zoning regulations. Within 97 requests, 50 were for residential uses, 21 for commercial and 27 for other. 12 (or 12.4%) out of 97 were denied by the BZA, which was a little bit lower than the 15% of average denial rate in

the District. 18 (or 18.6%) out of 97 were use variance applications, in which 6 (or 33.3%) were denied.

<div align="center">**Testing Hypothesis**</div>

In Chapter 3, four general hypotheses were proposed. They are:

Hypothesis 1 - Granting of variance applications is significantly higher than denial.

Hypothesis 2 - Opponents from affected neighborhoods influence the zoning administrative board's decision making.

Hypothesis 3 - Type of variance application affects the BZA's decision making.

Hypothesis 4 - The zoning administrative board does not place significant weight on suggestions from other public agencies in its decision making.

Zoning variance data in Washington D.C. from 1980 to 2009 are used in this paper to test the above four hypotheses. Hypothesis 1 was tested using the Binomial Test. Hypothesis 2 to 4 were tested in the basic Binary Response Model developed by the author. Statistical and econometric analysis can assist scholars and practitioners in the planning and law fields to better understand the situation of zoning variances.

Testing Hypothesis 1

Figure 5-2 shows the approval rate of variance applications by year, which provides a general view about the BZA's decisions. As indicated, the approval rate was maintained above 60% from 1980 to 2009. Although it is apparent in this graph that the granting of variance application is higher than denial, statistical analysis is a better way to test hypothesis without subjective judgment. The decisions were divided into two groups: approved applications from 1980 to 2009 and denied applications from 1980 to 2009. To test whether two groups are statistically different, we can use the Student's t-test analysis (Paired Sample T test) or the Binomial Test in a nonparametric test. The

Student's t-test analysis has relatively strict assumptions about the samples. It requires that the distribution of the samples is normal distribution, and all the samples are independent and random. Nonparametric test does not assume data should belong to any particular distribution. Compared to the Student's t-test analysis, the nonparametric test is preferable in this study. The Binomial Test in a nonparametric test is used to verify whether the distribution of dichotomous data is the same as the expected distribution. Assuming that the proportion of variance applications granted by the BZA is not different from the proportion of variance applications denied, meaning the proportions for both are the same (50% each).

Set out the null and alternative hypothesis in this test:

H0: the distribution of variance applications granted by the BZA is the same as the distribution of variance applications denied by the BZA.

H1: the distribution of variance applications granted by the BZA differs from the distribution of variance applications denied by the BZA.

We get the Binomial Test results (Table 5-3).In the table, Group 1 denotes the applications denied by the BZA and Group 2 denotes the applications granted by the BZA. The column "N" shows the number of cases in each group. As shown, 324 cases were denied by the BZA and 1816 cases were approved. The fourth column "Observed Prop." shows the frequency of each group in the observed cases. The fifth column is the proportion of decisions which were denied by the BZA. The last column "Asymp. Sig. (2-tailed)" shows the p value. The p value is 0.000 which is less than 0.05. Thus, the statistical test performed resulted in the rejection of the null hypothesis in favor of the alternative. It means that at a confidence level of 95% the proportion of variance

applications denied by the BZA is different from the proportion of variance applications approved. In another word, the denial rate is significantly different from the approval rate. Considering that the average approval rate is much higher than the average denial rate, we come to the conclusion that the granting of variance application is significantly higher than denial.

Testing Hypothesis 2 to 4

Chapter 3 explained the method of Binary Response model and its application. The author also constructed the framework of a basic binary response model according to the research questions. In this section, detailed model construction, data compilation and processing, results, and result analysis were demonstrated.

First, set out the null and alternative hypothesis in this test:

(1) Hypothesis 2

H0: opponents from affected neighborhoods do not influence the zoning administrative board's decision making.

H1: opponents from affected neighborhoods influence the zoning administrative board's decision making.

(2) Hypothesis 3

H0: type of variance application does not affect the BZA's decision making.

H1: type of variance application affects the BZA's decision making.

(3) Hypothesis 4

H0: the zoning administrative board does not place significant weight on suggestions from other public agencies in its decision making.

H1: the zoning administrative board places significant weight on suggestions from other public agencies in its decision making.

Format of model

There are two kinds of binary response model: probit model and logit model. A binary response model is referred to as:

> a probit model if F is the cumulative normal distribution function. It is called a logit model if F is the cumulative logistic distribution function. The logistic and normal distributions are both symmetrical around zero and have very similar shapes, except that the logistic distribution has fatter tails. As a result, the conditional probability functions are very similar for both models, except in the extreme tails. (Horowitz & Savin, 2001, p. 44)

As Wooldridge (2002) pointed out, the two models tell a consistent story. "The signs of the coefficients are the same across models, and the same variables are statistically significant in each model" (Wooldridge, 2002, p. 468). So with regards to the functional form of model, we can use both probit and logit models. However, if all of the independent variables are categorical or mixed with continuous and categorical variables, the logit model is then usually employed (Wuensch, 2011). Since the binary response model for the BZA's decision have categorical variables, the logit model is best applied in this study.

The equation of binary response logit model is as follows:

$$\text{Prob(event)} = \frac{e^{a_0 + a_1 x_1 + \cdots + a_n x_n}}{1 + e^{a_0 + a_1 x_1 + \cdots + a_n x_n}}$$

where $\mathrm{Prob(event)}$ is the predicted probability of the event which is given the value

of 1, $x_0, x_1, \ldots, x_n$ are independent variables, $a_0, a_1, \ldots, a_n$ are the parameters of

independent variables, and e is mathematical constant.

The above equation can be transformed to the following equation:

$$\mathrm{Odds\ Ratio} = \frac{\mathrm{Prob(event)}}{\mathrm{Prob(no\ event)}} = e^{a_0 + a_1 x_1 + \cdots + a_n x_n}$$

which shows the ratio of the probability of event to the probability of no event.

From the online documents provided by the D.C. Office of Zoning, the author

collected the needed information on recommendations from the OP, the ANCs, other

public agencies[10], opponents present at the public hearings and other forms of

communities' involvement except for being present at the public hearings, such as

letters, petitions and signatures. The variables of recommendations from the OP, the

ANCs, and other forms of communities' activities are categorical variables, containing

several outputs: support, opposition, no action, no objection and no data. The author

simplified the above outputs and classified them into three groups: support group,

opposition group, and no action/ no objection/ no data group. The first two groups have

clear views on the variance applications and the last group has no clear opinion.

Statistical analysis requires setting K-1 dummy variable to represent categorical groups.

For each dummy variable a score of 0 will indicate that the subject does not

belong to the group represented by that dummy variable and a score of 1 will

indicate that the subject does belong to the group represented by that dummy

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[10] Since it is required by law that BZA should give great weight to recommendation from OP, the author separated OP from other public agencies in this model.

variable. One of the groups will not be represented by a dummy variable. If it is

reasonable to consider one of your groups as a reference group to which each

other group should be compared, make that group the one which is not

represented by a dummy variable. (Wuensch, 2011, p. 11)

Considering the high approval rate of variance application, the opposite forces

which influence the BZA to deny applications perform very important roles. Whether

these forces affected the BZA's decision, and to what degree, is one of this study's

research questions. These forces might include opponents from the neighborhood, and

opposition from public agencies. Based on this consideration, the opposition group was

set as reference group in this model.

Other public agencies include, but are not limit to, the Department of

Transportation, the Department of Public Works, the Historic Preservation Review

Board, the Department of Human Services, the National Capital Planning Commission,

the Capitol Hill Restoration Society, etc. These agencies take part in the decision

process based on the type of lands, buildings, and locations. These agencies are

recommended by the Office of Zoning for review. Since not every agency got involved

into each case, the author combined their opinions together. There were situations

where one agency supported the application, while another agency recommended

denial. So in the model design, two variables are related to other public agencies. One

is a support from other public agencies: 1 means support and 0 means other situations;

the other is opposition from other public agencies: 1 means opposition and 0 means

other situations.

The independent variables in this binary response models are as follows:

• Use – The type of variance. 1= use variance and 0= area variance.

• OPSupport – Support from the Office of Planning. 1= Support and 0= other situations.

• OPNoaction – There was no action or no objection from the Office of Planning, or no data recorded in the document. 1= No action/ No objection/ No data, and 0=other situations.

• ANCSupport – Support from the Advisory Neighborhood Commissions. 1= Support and 0= other situations.

• ANCnoaction – There was no action or no objection from the Advisory Neighborhood Commissions, or no data recorded in the document. 1= No action/ No objection/ No data, and 0=other situations.

• HearingOppose – Opponents from neighborhood present at the public hearing. 1= Opponents showed up and 0=No opponents showed up.

• CRSupport – Support from communities. 1= Support and 0= other situations.

• CRNoaction – There was no action from communities. 1= No action and 0= other situations.

• OASupport – Support from other public agencies. 1= Support and 0= other situations.

• OAOppose – Opposition from other public agencies. 1= Opposition and 0= other situations.

The dependent variable is as follows:

• BZADecision – The Board of Zoning Adjustment's decision on variance applications. 1= Denial and 0= Grant.

Model results and testing

The author ran the crude model using Wald method which eliminated the variable CRSupport. Although other variables affect the BZA's decision significantly, the Hosmer-Lemeshow test shows that the model does not fit data. Multicollinearity was found in the model. It was found that OASupport is correlated with OPSupport, and CRNoaction is negatively correlated with HearingOppose. The above correlations are reasonable. Although reports from different public agencies focus on different aspects, all of them consider the benefits of the whole community. In all likelihood, they would probably come to the same opinion. Accordingly support from the OP is correlated with support from other public agencies. The negative correlation between no action from community and opposition in public hearing might imply that if no opponents appear at a public hearing, usually no action emerges from the community either. The author eliminated OASupport and CRNoaction from the model and ran the adjusted model again. Appendix A demonstrates the detailed process of model assessment and adjustment. The adjusted model includes seven independent variables.

Table 5-4 shows the significance, parameters of each variable, Wald test and the odds ratio (Exp(B)) of the model. The sixth column "Sig." provides the significance of each variable. At a 95% confidence level, all the variables included in the adjusted model satisfied the Wald test and Hosmer-Lemeshow test. The equation of this model is as follows:

$$\text{Prob(Denial)} = \frac{e^z}{1 + e^z} = \frac{1}{1 + e^{-z}}$$

In which

$$z = 0.880 + 0.682\text{Use} - 3.202\text{OPSupport} - 2.408\text{OPNaction} - 1.715\text{ANCSupport} -$$

$$0.854\text{ANCnoaction} + 1.070\text{HearingOppose} + 0.656\text{OAOppose}$$

Since the function $f(x) = \frac{1}{1+e^{-x}}$ is monotonically increasing, we know that the higher x is, the higher f is. In our model, the higher z is, the higher probability that a variance application is denied by the BZA. The parameters for the three variables Use, HearingOppose, and OAOppose have the positive value (Table 5-4, the second column B), which means that when they have the value of 1, the probability that a variance application is denied is higher than if they are given the value of 0. The degree of influence by opponents present at a public hearing is slightly higher than that of use variance and opposition from other public agencies. Since the variables of opposition from the OP and opposition from the ANCs were set as reference groups, we cannot directly see their influences in Table 5-4. However, from their counterparts we see how those counterparts, decrease the probability of variance applications denied by the BZA. The parameters of the categorical variables in this model are negative: the parameter of OPSupport is -3.202; the parameter of OPNoaction is -2.408, the parameter of ANCSupport is -1.715; and the parameter of ANCnoaction is -0.854. The absolute value of the parameter of OPSupport is higher than the absolute value of parameter for ANCSupport, which implies that the influence of the OP to the BZA's decision is higher than that of the ANCs. The negative parameters of the variables that no action from the OP and no action from the ANCs also imply that when there is no clear stance from either body, or the lack of recommendation to the BZA, the effect is not neutral. The probability of granting variance application increases in this situation. The results of

significance for OPNoaction, ANCnoaction and their negative parameters should be paid attention. There might be two explanations: since there were a large amount of cases in which there was no involvement from the OP, or the ANCs and the granting ratio remained high during these 30 years, the model related the two and emphasized the significance. Indeed, there may be no relationship. Another explanation is that it might suggest to some extent no action/no objection is a kind of acquiescence, which sends a signal to the BZA to incline towards granting the application. It is hard to fathom which explanation is more reasonable according to the existing literature. More information is needed to further study this question.

The results of the model also provide us with the following information:

(1) Type of variance application

The odds ratio for "Use" shows that when holding all other variables constant, use variance application is 1.978 times more likely to be denied by the BZA than area variance application. As shown in the section on Zoning Variance in Washington D.C. in Chapter 4, the test of "practical difficulties" is applied to area variances and "undue hardship" is applied to use variances. The conditions to grant a use variance application are already stricter than the conditions to grant an area variance from the legal perspective. This result may indicate that the BZA is more prudent in granting a use variance, which might more negatively impact to the community.

(2) Opponents appeared at the public hearing

The odds ratio for "HearingOppose" indicates the variance application is 2.916 times more likely to be denied when there is an opponent present at the public hearing

than when no opponents is present. In terms of probability, it predicts 74.5% of cases would be denied by the BZA when an opponent is present at the public hearing.

(3) Recommendation from other public agencies

Although in the crude model OASupport is statistically significant, it was eliminated in the adjusted model due to its correlation with OPSupport. On the other hand, the odds ratio of "OAOppose" reflects that the variance application is 1.927 times more likely to be denied by the BZA than when there is opposition from other public agencies than in other situations. The model predicts that 65.8% of variance applications would be denied by the BZA when there are other public agencies which oppose the applications.

(4) Other forms of community involvement

In the crude model, the variable CRSupport was excluded from the model according to Wald method, which means that support from residents in the community does not affect the BZA's decision significantly. CRNoaction was significant, which means other forms of opposition from the community exert a significant influence on the BZA's decision compared to no action from the community. However, it was negatively correlated with opponents present at the public hearing. This correlation implies that in the cases where opponents were present, other forms of community opposition might also occur.

(5) Recommendation from the OP

The odds ratio of the categorical variable compares each scenario except opposition to the opposition scenario. The inverted odds ratio compares the opposition scenario to another scenario. The result shows that the variance application is 24.4

(1/0.041) times more likely to be denied when the OP opposes the application than when the OP supports the application. This vast difference reveals that the influence of the recommendations from that OP is essential to the BZA's final decision.

The inverted odds ratio shows the variance application is 11.1(1/0.090) times more likely to be denied when the OP opposed the application than when the OP exhibits no action/no objection. The above results are reasonable and can be explained simply. When the OP has a clear stance about the application, the BZA's decision is relatively consistent with the OP's recommendation. No clear stance stands between opposition and support and the likelihood that the BZA denies the application stands between the likelihood of the OP's opposition and he OP support.

(6) Recommendation from the ANCs

The inverted odds ratio indicates that the variance application is 5.5 (1/0.180) times more likely to be denied by the BZA when the ANCs oppose the application than when the ANCs support it. The inverted odds ratio indicates that the variance application is 2.3 (1/0.426) times more likely to be denied by the BZA when the ANCs oppose the application than when there is no action/ no objection from the ANCs.

According to the above results, we reject the null hypothesis in hypothesis 2 which states that opponents from affected neighborhoods do not influence the zoning administrative board's decision making. At least in Washington D.C.,the null hypothesis is rejected. The opponents from the neighborhood affect the board's final decision. The forms of opposition include opponents appearing in public hearings, opponents writing letters to the board, and opponents petitioning, etc. The participants could be individuals,

several persons who join as one group, a local community association, or the representatives of a stakeholder.

As to hypothesis 3, as indicated above, the odds ratio for "Use" shows that when holding all other variables constant, use variance application is 1.978 times more likely to be denied by the BZA than an area variance application. If we consider this one variable in the model, it predicts that 8.5% of area variance will be denied by the BZA and 32.2% of use variance will be denied by the BZA. Thus we reject the null hypothesis in hypothesis 3 which states that type of variance does not affect the BZA's decision.

For hypothesis 4, we partially reject the null hypothesis that the zoning administrative board does not place significant weight on suggestions from other public agencies in its decision making. As the result shows, the BZA's decisions were highly consistent with the OP and the ANCs' recommendations for both granted cases and denied cases. Supports from the OP or the ANCs tended to influence the BZA decision to grant the variance applications, and oppositions from the OP or the ANCs tended to influence the BZA in denying the variance applications. The variance application is 24.4 (1/0.041) times more likely to be denied when the OP opposes the application than when the OP supports the application. And the variance application is 2.3 (1/0.426) times more likely to be denied by the BZA when the ANCs oppose the application than when there is no action/ no objection from the ANCs. In the second column of

Table 5-4 which shows the parameter of each variable, the parameter for OPSupport is -3.202 and the parameter for ANCSupport is -1.715. The above values mean that the influence of support from the OP was also higher than the influence of

support from the ANCs. Besides the OP and the ANCs, other public agencies also play important roles in the process and their recommendations significantly affect the BZA's decision when they oppose the application. Opposition from other public agencies increases the probability that the BZA denies a variance application. However, statistical analysis indicates that support from public agencies does not make any difference in the BZA's ultimate decision making.

Overall, the OP exhibited the strongest influence in affecting the BZA's decision. The second strongest factor is weight of the ANCs. This finding is in accordance with the zoning ordinances in Washington D.C. As two major public agencies involved in the procedure of zoning variance application, the input of OP and the ANCs assist the BZA in making a fair decision. The influence of opponents present at the public hearing is weaker than the recommendations from the OP and the ANCs, yet it is stronger than type of variance and recommendation from other public agencies (the OP and the ANCs are excluded from the other public agencies).

Assessment of the model

Table 5-5 shows the -2 log likelihood statistic and the coefficient of determination R Square. R square in OLS regression measures to what extent a model can explain the dependent variable. "In logistic regression, there is no true R^2 value as there is in OLS regression" (Newsom, 2010, p. 1). The Cox & Snell R square and Nagelkerke R square in the logit binary response model are two methods to represent the function of R square in OLS regression. The larger the value is, the more the model explains the dependent variable. However, the maximum value of The Cox & Snell R square is less than1. Since Nagelkerke R square ranges from 0 to 1, it is preferably used in model explanation. In the adjusted model, the Cox & Snell R square is 0.232 and Nagelkerke

R square is 0.406. It indicates that the independent variables in our model can explain 40.6% of the BZA's final decisions.

The Hosmer-Lemeshow test is used to test the overall model fit. The null hypothesis shows that the model fits the data well. As Table 5-6 shows, the value of "Sig" is 0.122, which is larger than 0.05. It indicates that the data fit the model well. Classification Table (Table 5-7) shows the cross table of the observed amount of dichotomous dependents and the predicted amount of dichotomous dependents. As Table 5-7 shows, the 1,501 cases granted and the 252 cases denied by the BZA were predicted correctly by the model; the 72 cases denied by the BZA were predicted to be granted by the BZA; and 315 cases granted by the BZA were predicted being denied by the BZA. In terms of granting, the correct rate is 82.7% and in terms of denial, the correct rate is 77.8%. The overall correct rate in this model is 81.9%[11].

The ROC curve is one method to evaluate the performance of the classification table. "A ROC curve is a graphical representation of the tradeoff between the false negative and false positive rates for every possible cut off" (Abrahams & Zhang, 2008, p. 316). The value of the area under the curve is between 0.5 and 1. The closer the area is to 1, the better the classification table performs. Figure 5-26 shows the ROC curve for this binary response model.

As Table 5-8 shows, the area under the ROC curve is 0.869. This value is close to the value 1 and much larger than the value of 0.5. This value could be considered as an ideal value in this test. The binary response model is quite sufficient model to predict the

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[11] The author decided to use 0.150 as a cut value in this model in order to balance the correct rate between grant and denial. It means that we assume that when the probability of denial in this model is above 0.150, the BZA would deny the variance application. And when the probability of denial is under 0.150, the BZA grants the variance application.

BZA's decision based on recommendations from the OP, the ANC, Other public

agencies, type of variance, and whether there is an opponent present at a public

hearing.

Further Investigation

Other Factors

The basic binary response model above is applied to testify Hypothesis 2, 3 and 4.

As shown in the above section, the results are convincing and reasonable. The BZA's

decisions are affected by recommendations from the OP, the ANCs, and other public

agencies. Moreover, opponents present at a public hearing did influence the BZA's

decisions compared to no opponents attending a public hearing. Although it should not

be one of the conditions required by law to grant/deny variance application, opponents

do impact the BZA's decision making as most researchers pointed out. Type of variance

also affects the BZA's decision. Use variance is almost twice as likely to be denied than

area variance.

Besides the above factors which were tested in the basic binary response model,

the author conducted further investigation on other possible factors that might also

affect the BZA's decisions, which include property area, land value[12], existing type of

property (residential, commercial, mixed use, other), and type of variance applicant

(individual, firm, other). These variables were added into the basic binary response

model and tested by statistic methods. Besides statistic reasonability, the author also

verified reasonability in reality. Since the data for land value did not cover all 2,140

cases, in this step 1,301 cases, which have the data of land value, were used for

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[12] Property area and land value in this model were transformed using the logarithm function for statistic reason.

statistical analysis. Due to the limitation of data availability, the results in this section might not fully represent the facts. So the author focused more on general characters rather than detailed numbers. The analysis here may provide guidance for further research.

The statistic results showed that with the exception of land value, other variables do not affect the BZA's decision significantly. The parameter of the logarithm function for land value is negative, which means the land value decreases the probability that the BZA denies the application. The larger the land value, the lower the probability that the BZA denies the application. This finding might imply that economic power affects the BZA's decisions potentially.

Clustering of Zoning Variance

Spatial analysis was applied to test whether variances are clustered as a result of 30 years' accumulation. As pointed out in the literature review, researchers found evidence of clustering of variances which might lead to further granting of variances or rezoning ("Zoning Variance and," 2005). From Figure 5-17, variance applications are shown to be concentrated in Ward 1, Ward 2, and Ward 6. Whether these variance applications are spatially clustered, which has statistical significance, is the question in this section. Hot spot analysis in ArcGIS was applied to test the distribution of variance applications.

Hot spots refers to "concentrations of incidents within a limited geographical area that appear over time" ("A Spatial Statistics," 2010, Chapter 6 p.1). Hot spot analysis is widely applied in the examination of crime locations to identify the areas where crime occurs with high frequency. It is also widely applied in some emergency preparedness programs ("A Spatial Statistics," 2010). ArcGIS provides hot spot analysis which can

identify and map clusters of incidents. It calculates the Getis-Ord Gi statistic, which measures spatial clustering. The author applied this tool to identify whether cluster of variance applications and decisions existed over the 30 year period and where these variances were concentrated. Appendix C shows the detailed process of hot spot analysis in this research.

Figure 5-27 shows the results of hot spots analysis. The red color in this map covers the area where variance applications were spatially clustered with statistical significance. The area with red color is located in the center of the District, which includes the southern part of Ward 1, the northeast part of Ward 2, and the northern part of Ward 6. It is the busiest and most active area in the city. It includes central business districts, has a high population density, and is undergoing development activities.

The dark blue color covered areas are also variance applications clustered areas. The difference between the red and dark blue is that the in the red areas the concentration of applications was more intense and some variance applications occurred in the same location. The light blue color means that in its areas variance applications were not clustering in a statistically significant manner. It is apparent that in Ward 3 the variance applications were not clustered. Although in Ward 4, Ward 5, Ward 7 and Ward 8, the total number of variance applications was less than that in Ward 3; the map shows that in these four wards the applications were concentrated in some certain areas. This map implies that the activities of variance applications in Washington D.C. were not evenly distributed. The coincidence that some locations had variance applications' spatial concentration, local economic activities and development activities

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may reflect some inner causal relationship between economic activities and variance applications. This is a question which needs more material for further research.

As mentioned above, the red color also means that the locations of variance applications are closely connected to each other, including the situation that several applications occurred in the same location. The data shows that there were 137 locations which had more than 2 variance applications during 1980 to 2009, in which 8 locations had 4 variance applications and 9 locations had 3 variance applications. Figure 5-28 shows the locations which have more than two variance applications. They are mainly concentrated in the middle of the District. Within these 137 locations, 56 (or 40.9%) locations are for commercial use. Compared to the 25% average rate of properties for commercial use in zoning variances, this number is much larger. This fact reflects that residential properties are relatively more stable than commercial properties in terms of conforming to zoning ordinances under the condition that the location had previous zoning variance application.

Figure 5-29 shows the approved variance applications hot spots. It is very similar to the variance application hot spots (Figure 5-27). The comparable hot spots distribution implies that there was no apparent bias from the BZA's decisions in terms of the location of property. The spatial concentration of granted variance stems from the spatial concentration of variance applications.

Table 5-1. Cross-tabulation of approval and denial rate under different recommendations from the Office of Planning, the ANCs, and the community

	OP Opposition	OP Support	ANCs Opposition	ANCs Support	Community Opposition	Community Support
Approval	38%	93%	57%	93%	67%	80%
Denial	62%	7%	43%	7%	33%	20%

Table 5-2. Cross-tabulation of approval rate by property use and type of applicant

	Total Approval Rate	Residential Approval Rate	Commercial Approval Rate	Mixed Use Approval Rate	Other Approval Rate
Firm	88.9%	91.1%	88.0%	97.3%	76.9%
Individual	79.8%	82.9%	68.3%	100.0%	65.2%
Other	93.9%	93.1%	100.0%	NA	93.7%

Table 5-3. Binomial test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
decision	Group 1	1	324	.15	.50	.000(a)
	Group 2	0	1816	.85		
	Total		2140	1.00		

a Based on Z Approximation.

Table 5-4. Significance and parameters of variable in binary response model

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	Use	.682	.182	14.098	1	.000	1.978
	OPSupport	-3.202	.221	209.108	1	.000	.041
	OPNoaction	-2.408	.178	182.321	1	.000	.090
	ANCSupport	-1.715	.227	56.842	1	.000	.180
	ANCnoaction	-.854	.211	16.351	1	.000	.426
	HearingOppose	1.070	.180	35.396	1	.000	2.916
	OAOppose	.656	.319	4.222	1	.040	1.927
	Constant	.880	.241	13.378	1	.000	2.411

a Variable(s) entered on step 1: Use, OPSupport, OPNoaction, ANCSupport, ANCnoaction, HearingOppose, OAOppose.

Table 5-5. -2 Log likelihood statistic and the coefficient of determination R

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	1253.647(a)	.232	.406

a Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

Table 5-6. Hosmer and lemeshow test

Step	Chi-square	df	Sig.
1	11.407	7	.122

Table 5-7. Classification table of binary response model

Observed			Predicted		
			BZA's Decision		Percentage Correct
			Grant	Denial	
Step 1	BZA's Decision	Grant	1501	315	82.7
		Denial	72	252	77.8
	Overall Percentage				81.9

Note: the cut value is .150

Table 5-8. Area under the curve

Test Result Variable(s): Predicted probability

Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic	95% Confidence Interval	
				Lower Bound	Upper Bound
.869	.011	.000		.847	.892

The test result variable(s): Predicted probability has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.
a Under the nonparametric assumption
b Null hypothesis: true area = 0.5
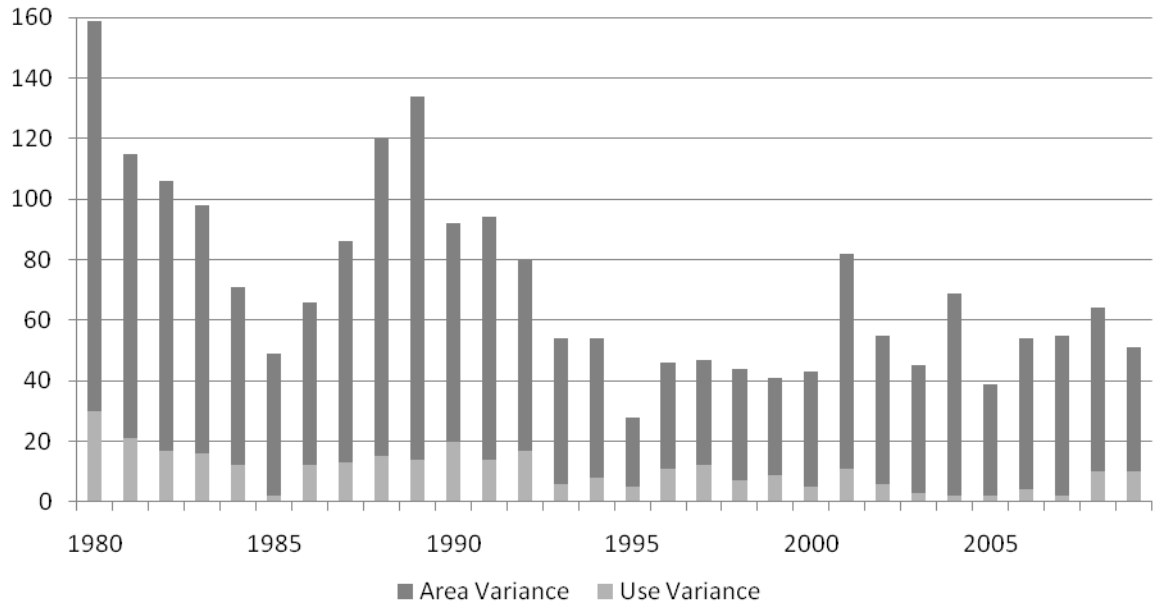
Figure 5-1. Number of variance applications by type and year[13]
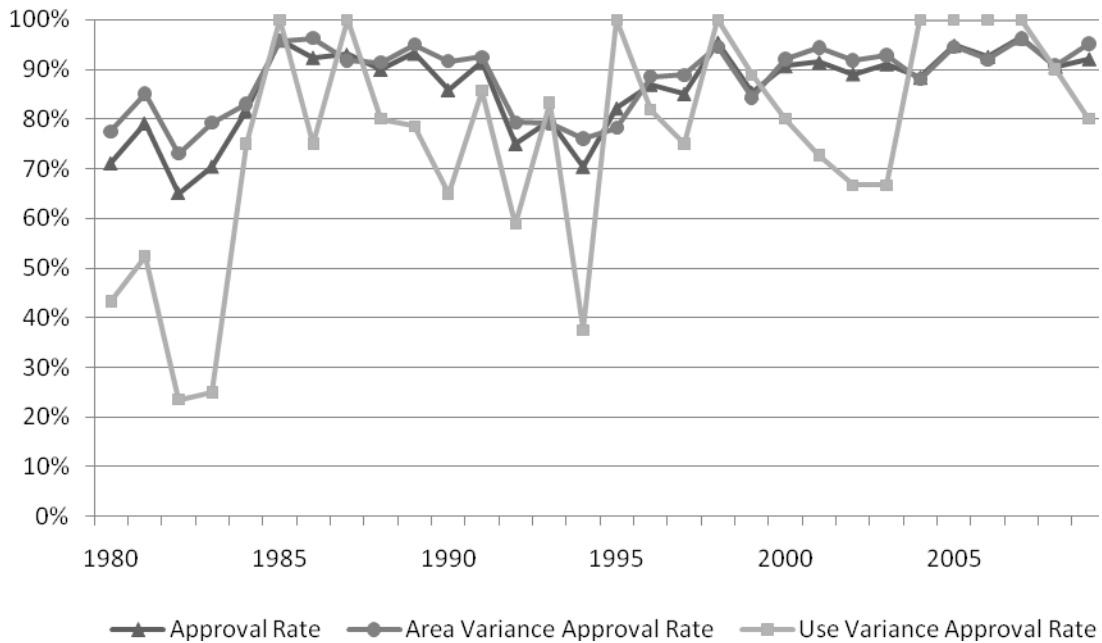
Figure 5-2. Approval rate by type of variance and year

[13] Note: Data for 1985 for four months from May 15 to Sep. 25 are not available form Office of Zoning website.
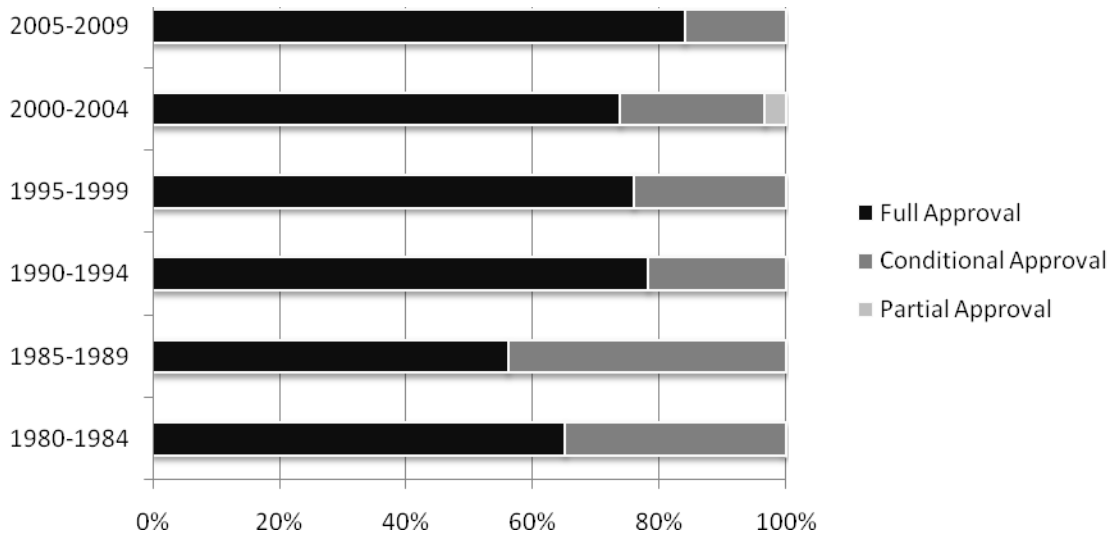
Figure 5-3. Area variance approval rate by approval type in approved applications by every five years from 1980 to 2009
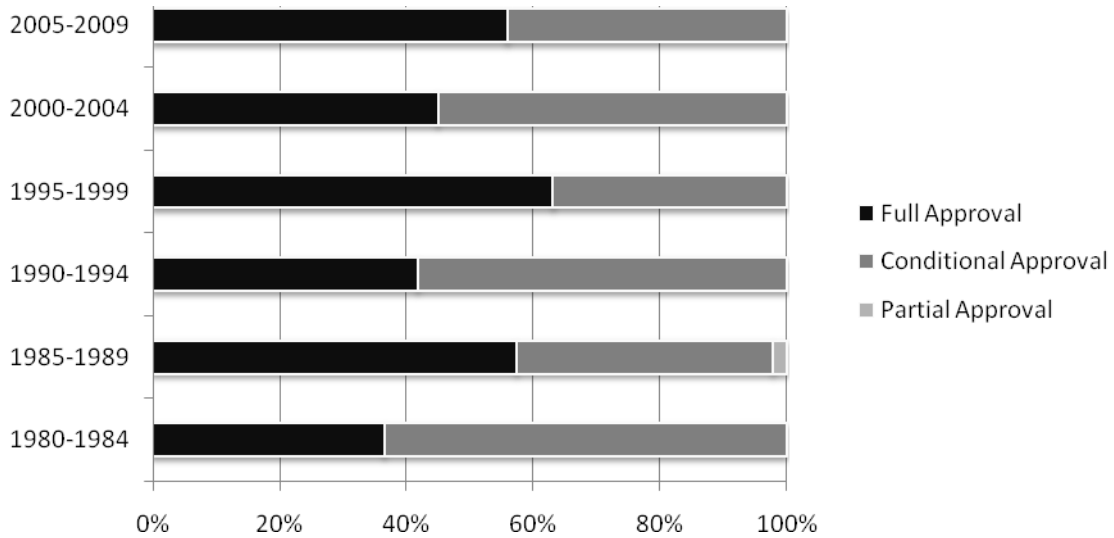
Figure 5-4. Use variance approval rate by approval type in approved applications by every five years from 1980 to 2009
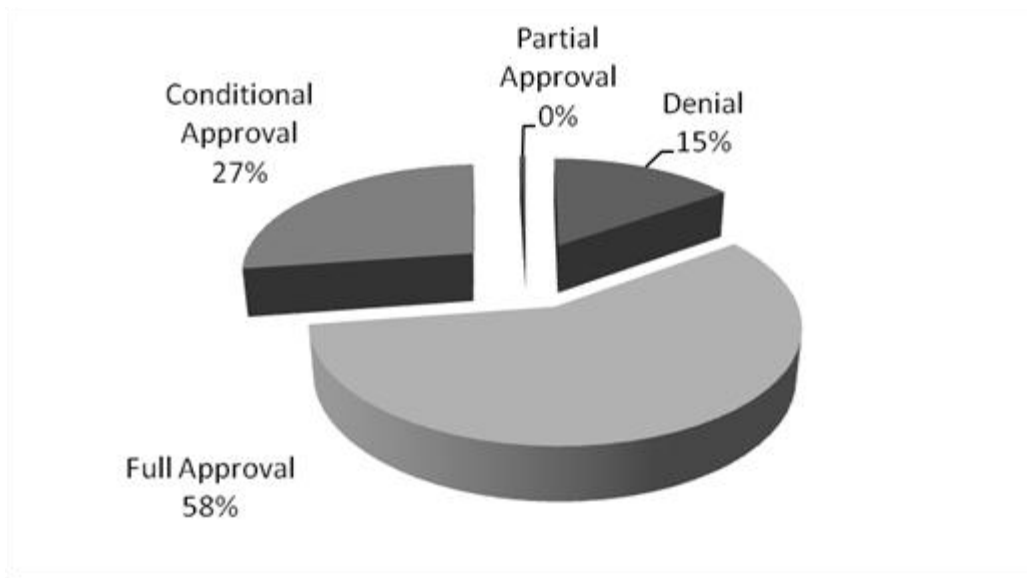
Figure 5-5. the final decisions from the BZA
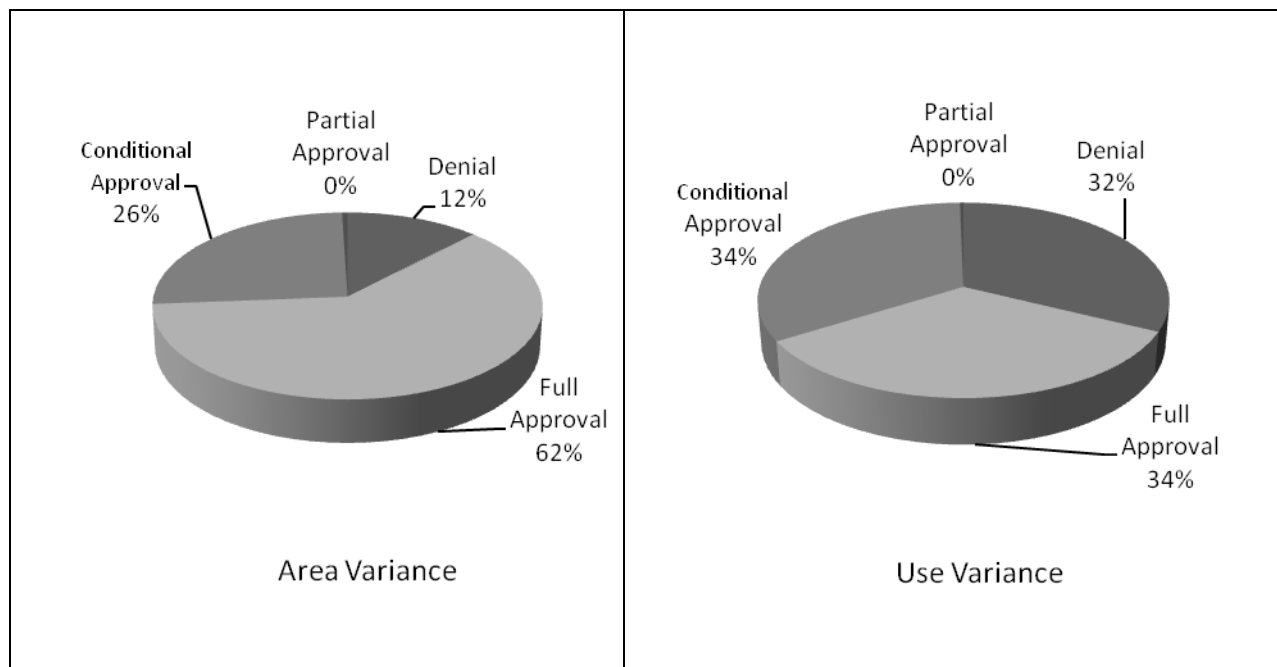
Figure 5-6. the final decisions from the BZA by type of variance
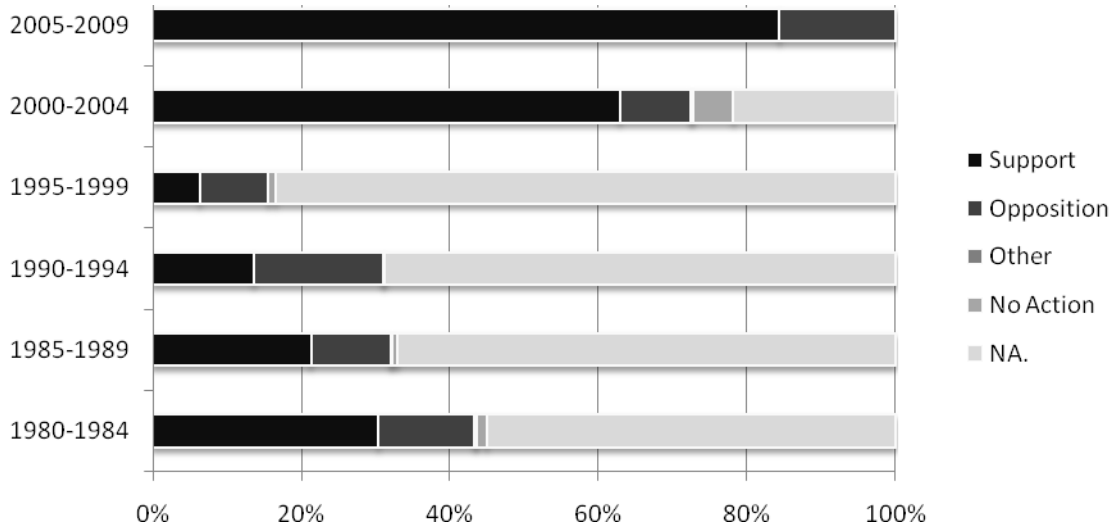
Figure 5-7. The Office of Planning involvement by every five years
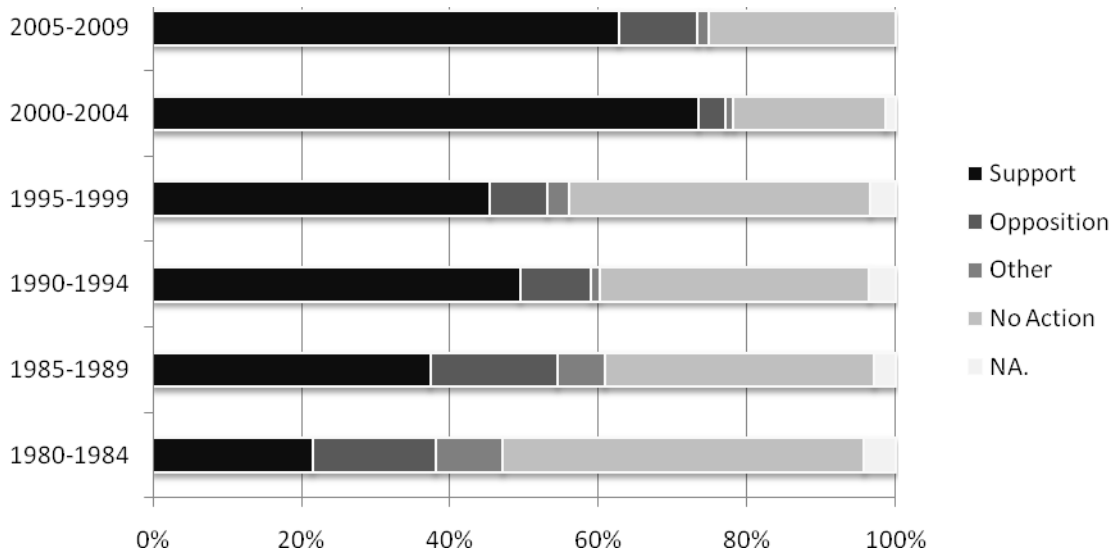
Figure 5-8. The ANCs involvement by every five years
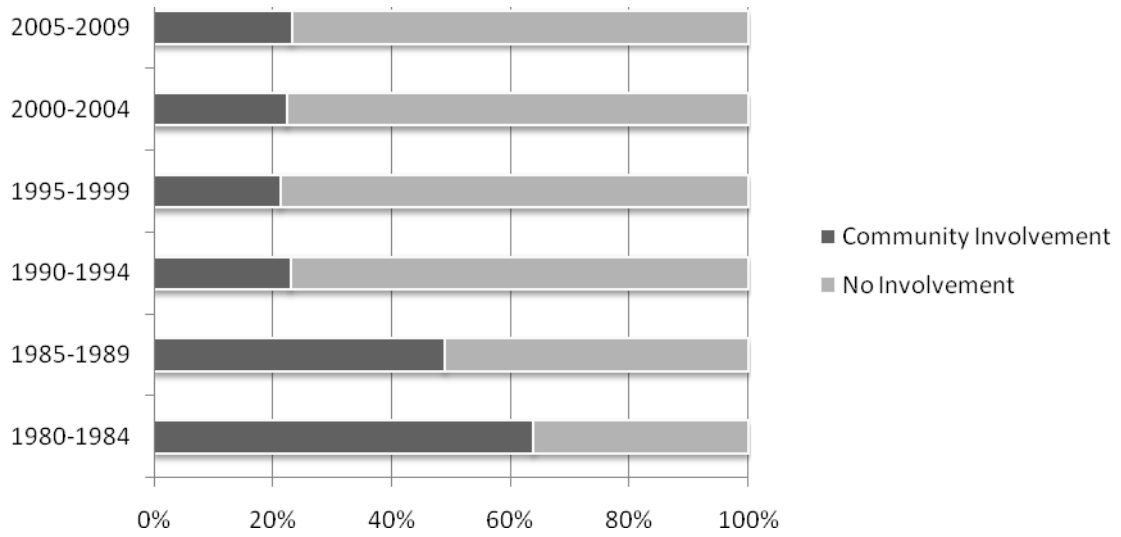
Figure 5-9. The community involvement by every five years
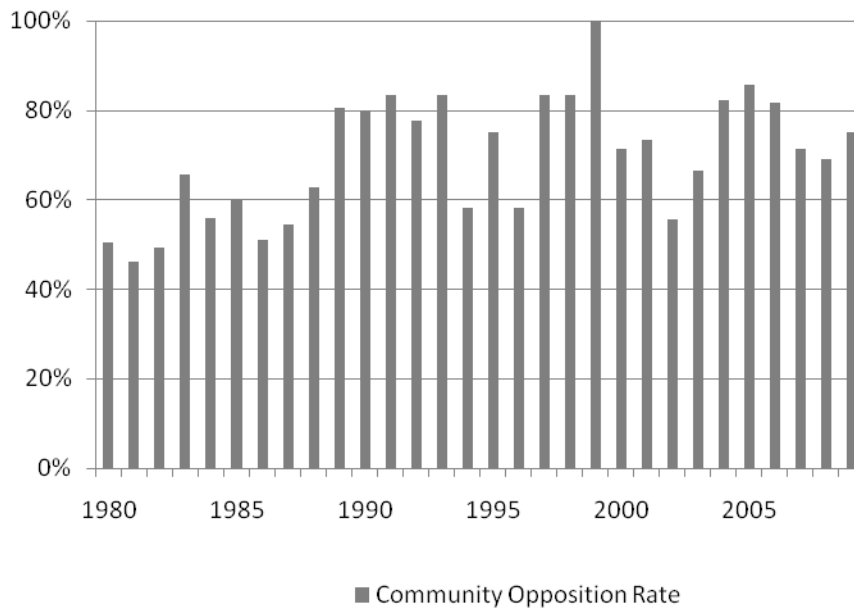
Figure 5-10. Community opposition rates in cases where the community was involved
    by year
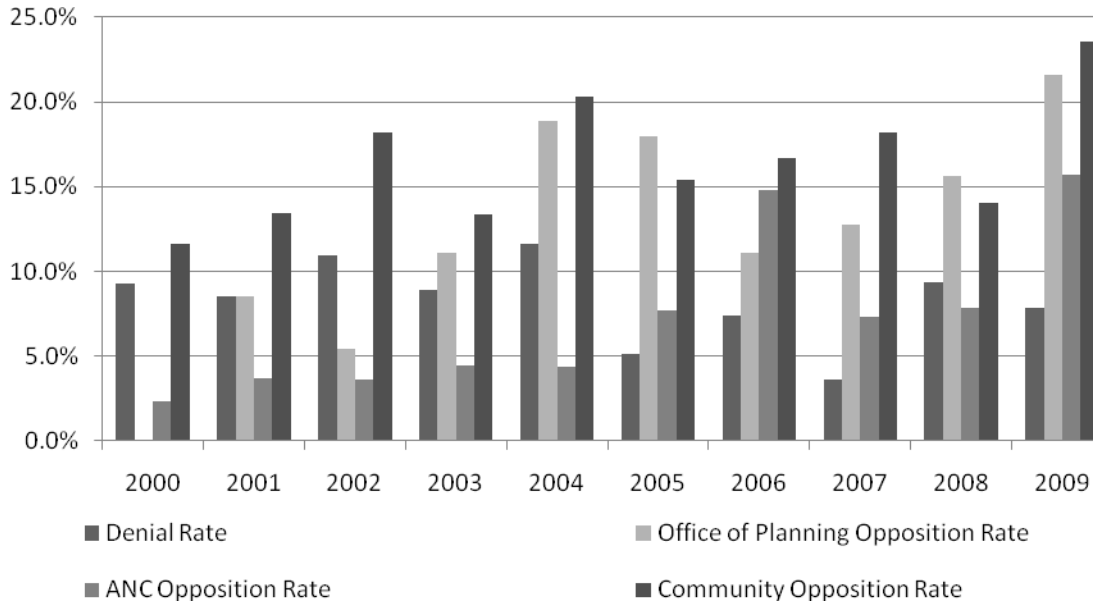
Figure 5-11. Comparisons between denial rate, the Office of Planning opposition rate, the ANCs opposition rate and community opposition rate by year from 2000 to 2009
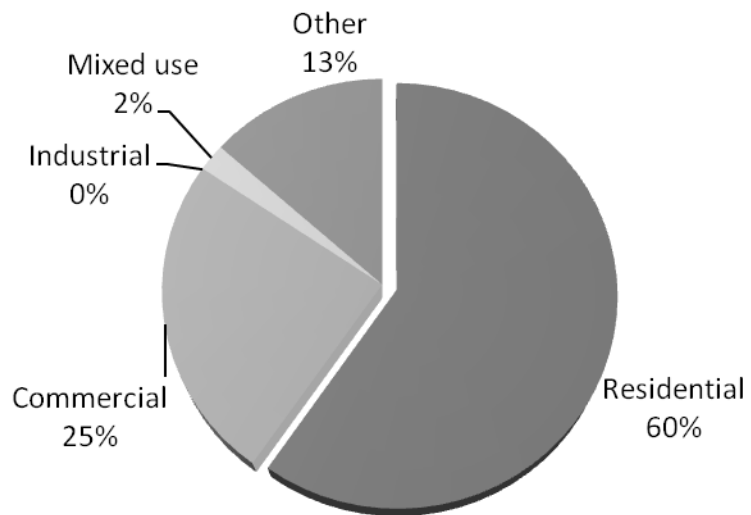
Figure 5-12. Use of properties requested for zoning relief
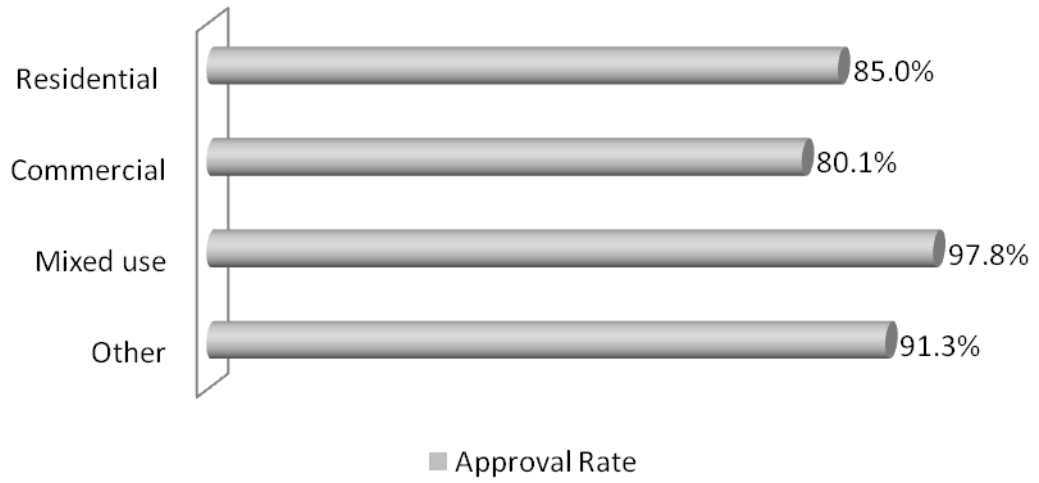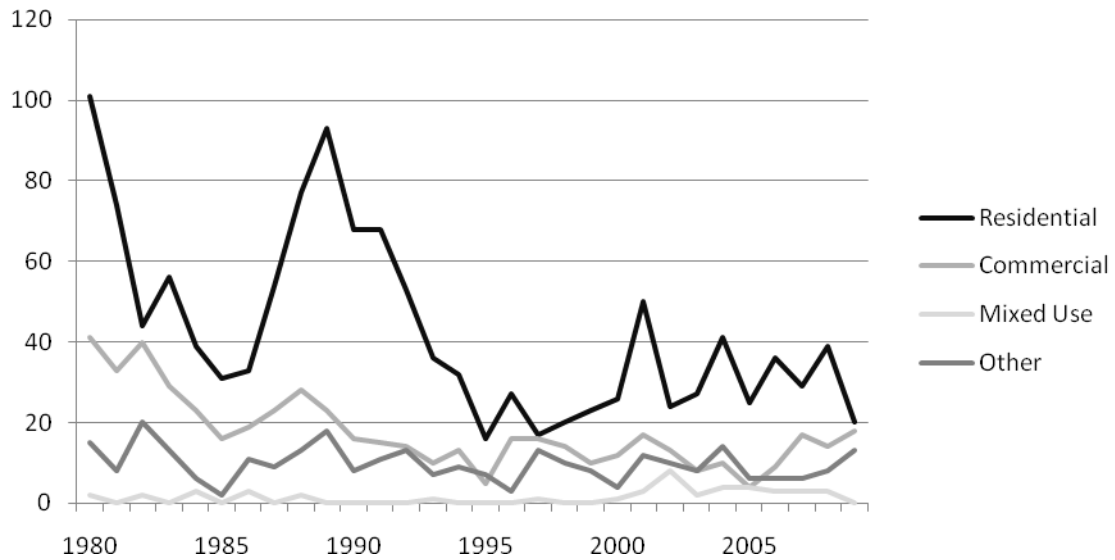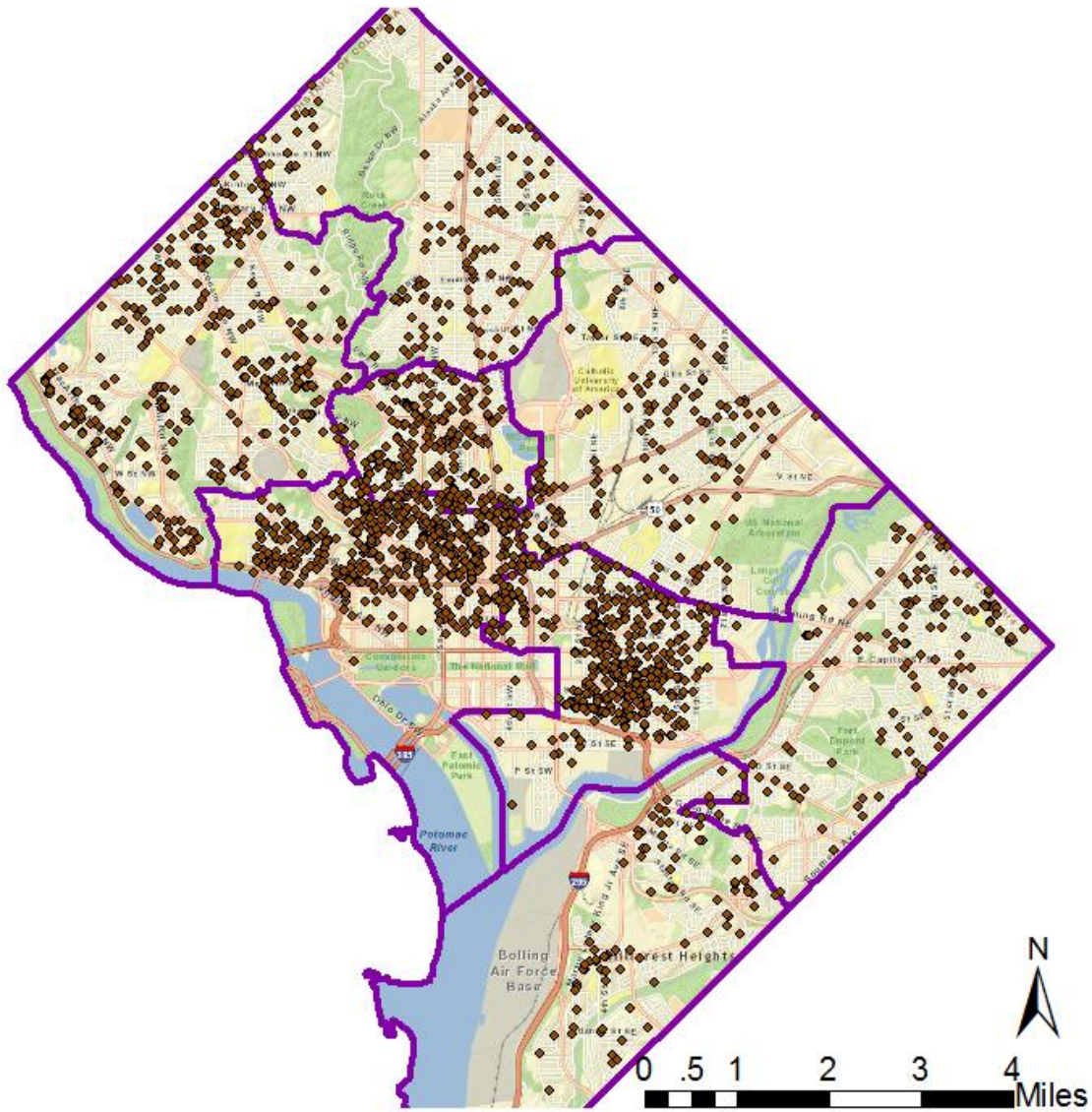
Figure 5-13. Approval rate by property use

Figure 5-14. Number of variance applications by property use by year

Legend

- ◆ Distribution of Variance Applications
- □ Washington D.C. Boundary
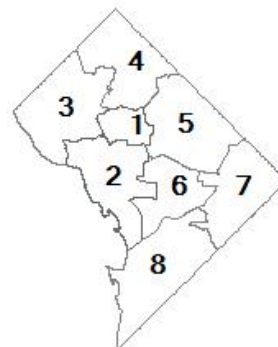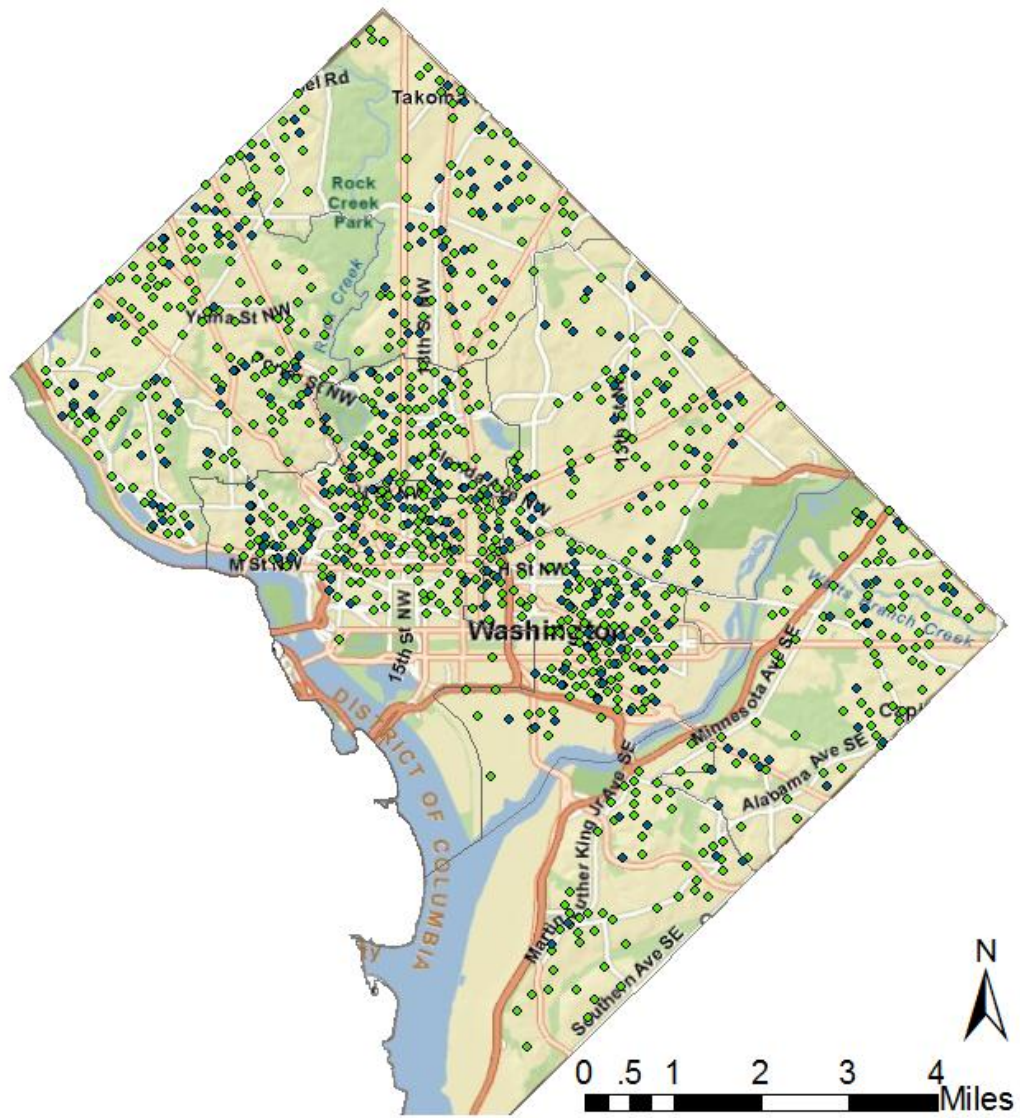- World Street Map
- ▨ Waterbodies
- ▨ Parks

Figure 5-15. Distributions of variance applications from 1980 to 2009 by Ward
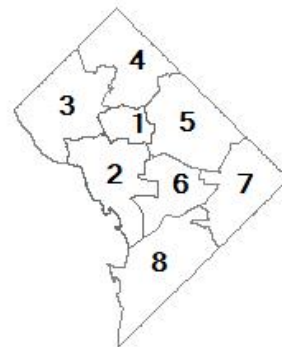
Figure 5-16. Distribution of approved and denied variance applications from 1980 to 2009

Figure 5-17. Distributions of variance applications and decisions in Ward 1 from 1980 to 2009

Figure 5-18. Distributions of variance applications and decisions in Ward 2 from 1980 to 2009

Figure 5-19. Distributions of variance applications and decisions in Ward 2 by decennial periods
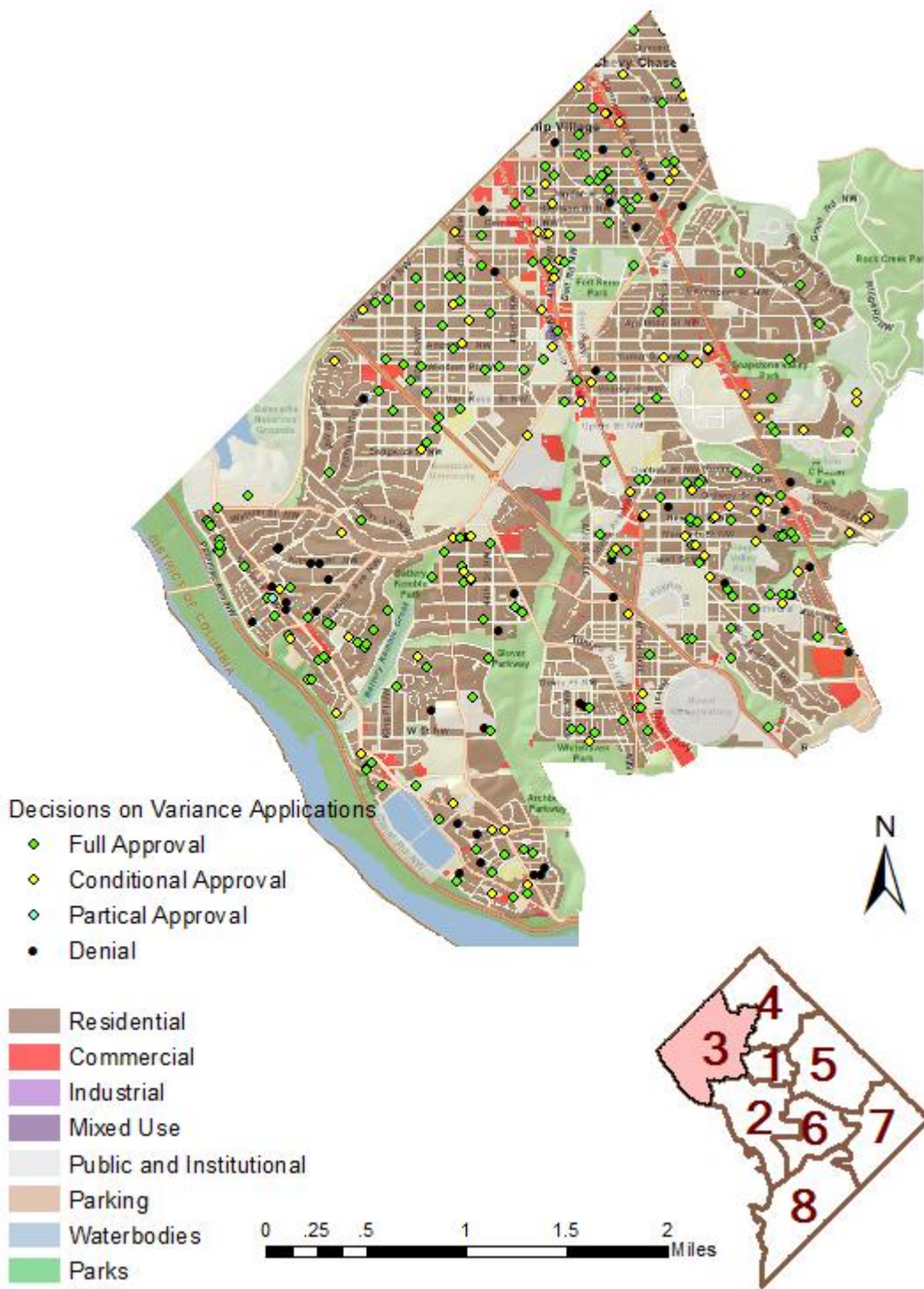
Figure 5-20. Distributions of variance applications and decisions in Ward 3 from 1980 to 2009
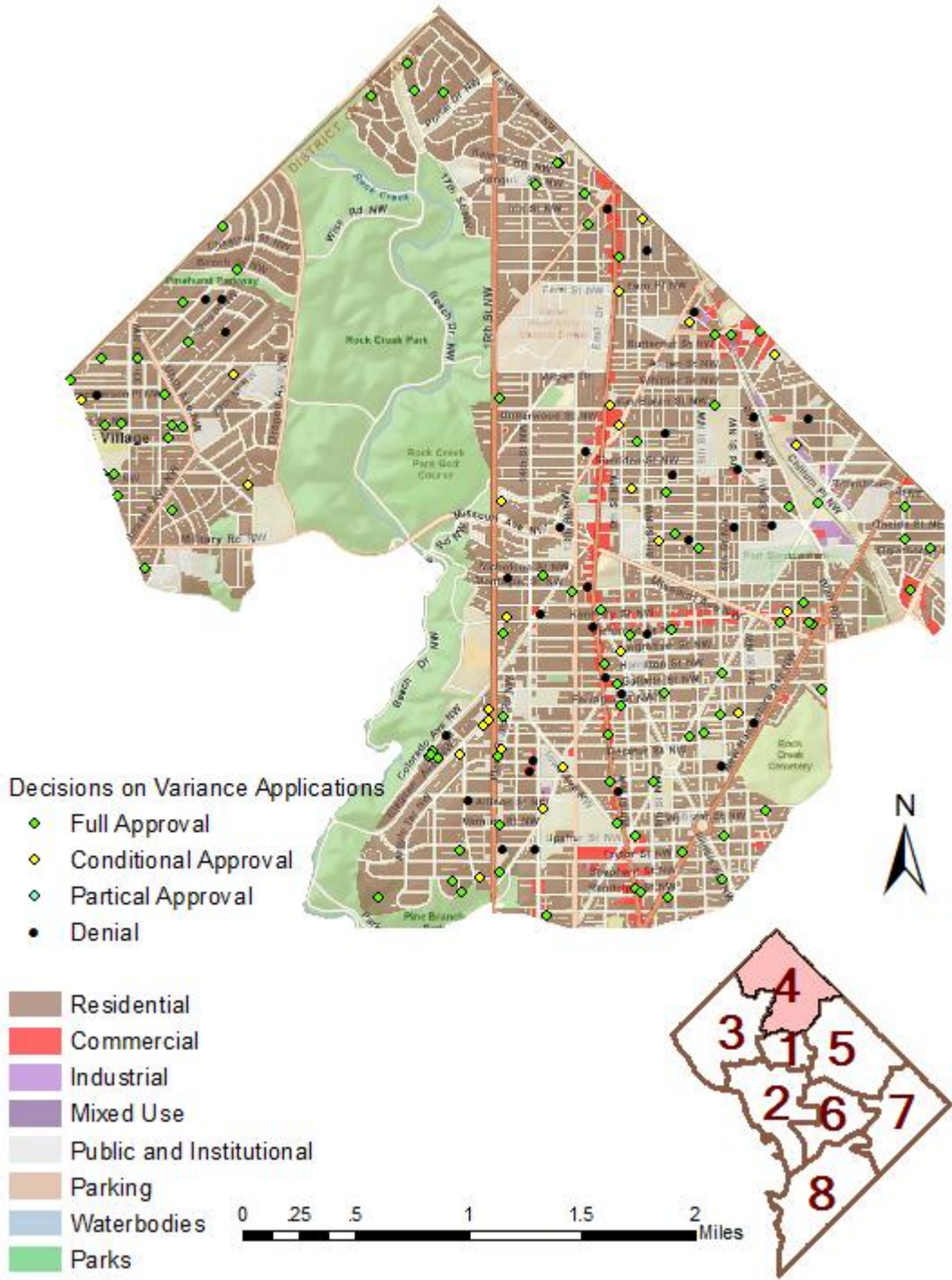
Figure 5-21. Distributions of variance applications and decisions in Ward 4 from 1980 to 2009

Decisions on Variance Applications
- ◇ Full Approval
- ◇ Conditional Approval
- ◇ Partical Approval
- ● Denial

Residential
Commercial
Industrial
Mixed Use
Public and Institutional
Parking
Waterbodies
Parks

0   .25   .5   1   1.5   2
Miles

N
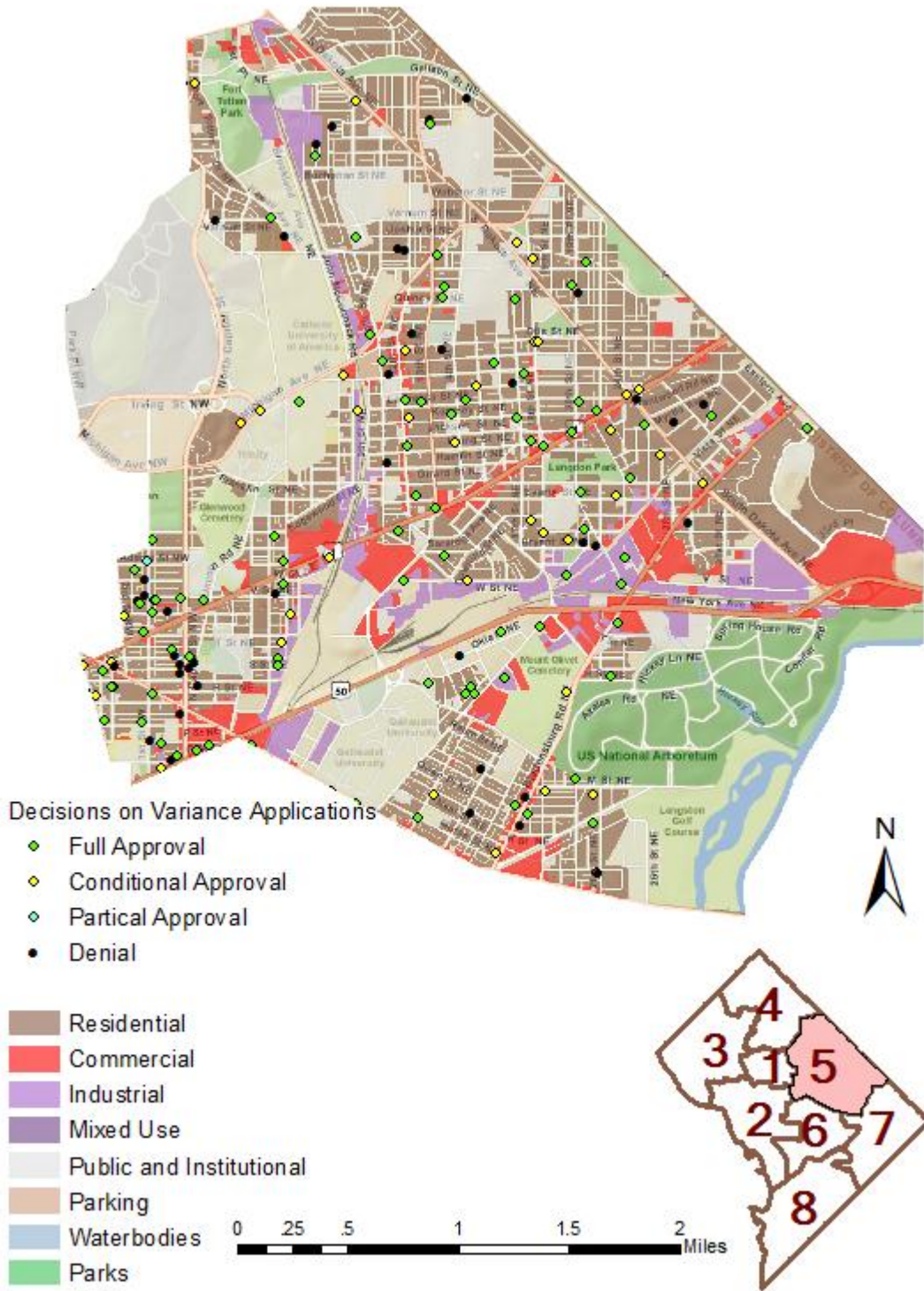
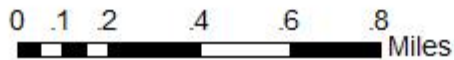Figure 5-22. Distributions of variance applications and decisions in Ward 5 from 1980 to 2009
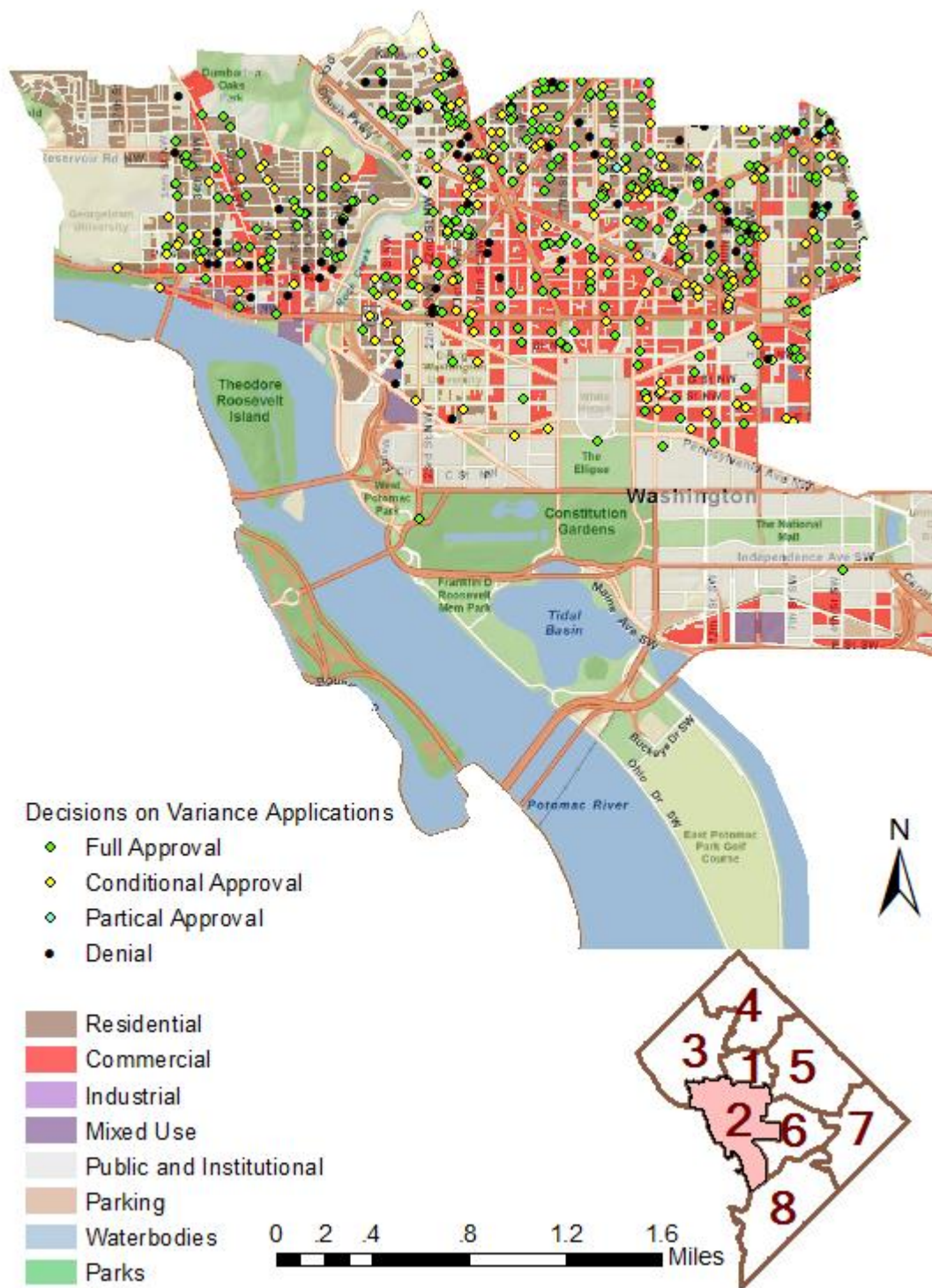
145
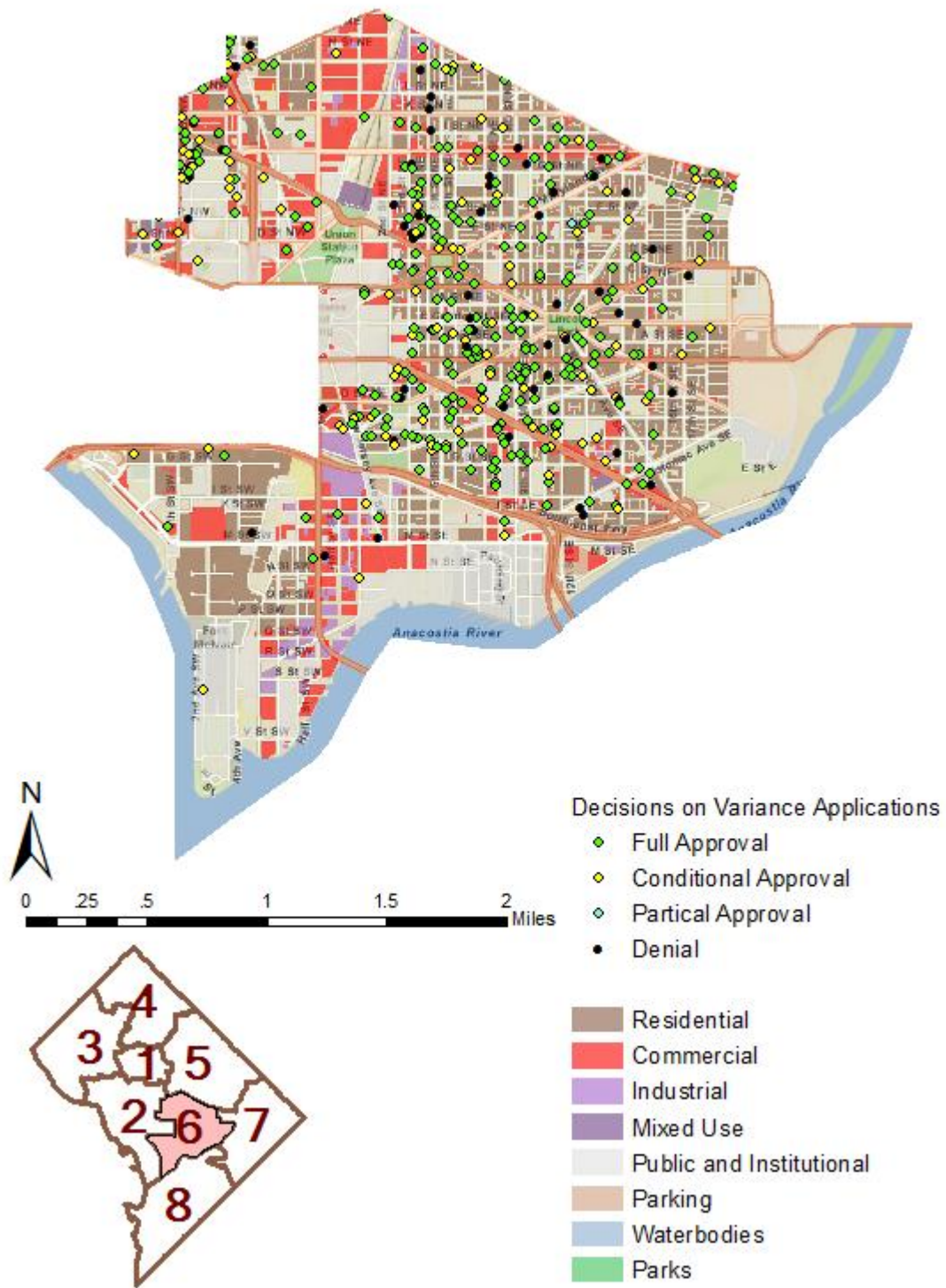
Figure 5-23. Distributions of variance applications and decisions in Ward 6 from 1980 to 2009
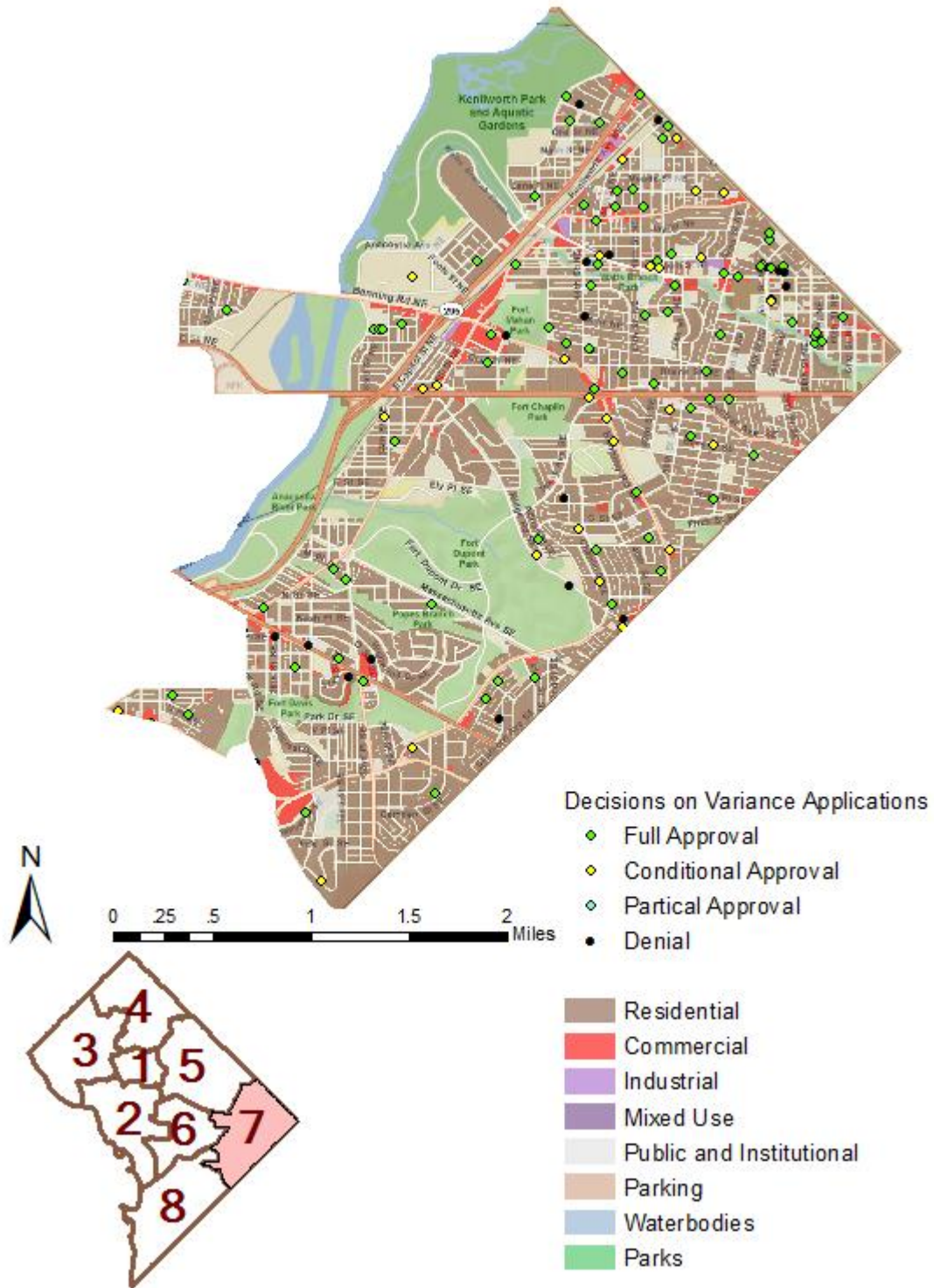
Figure 5-24. Distributions of variance applications and decisions in Ward 7 from 1980 to 2009
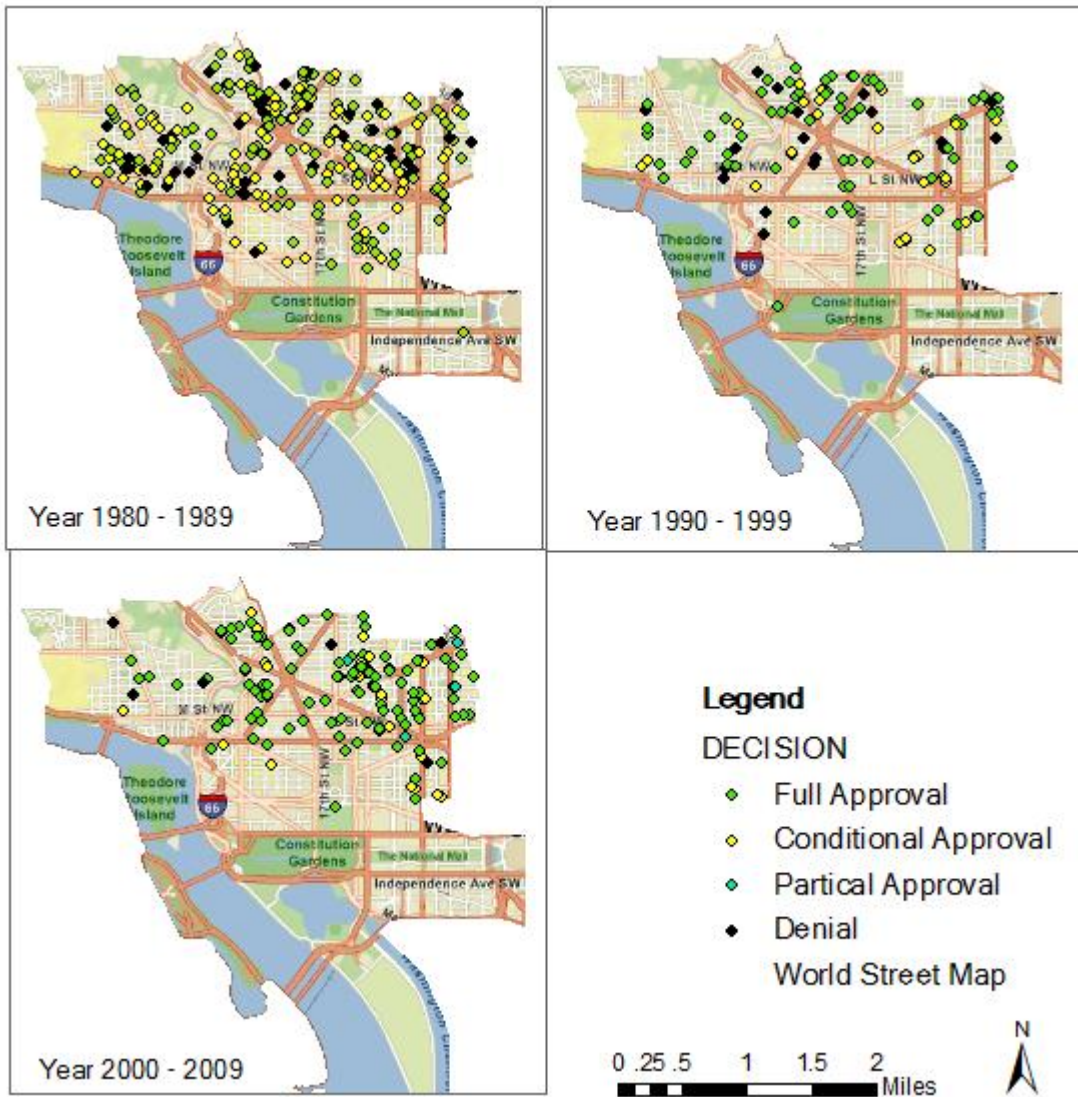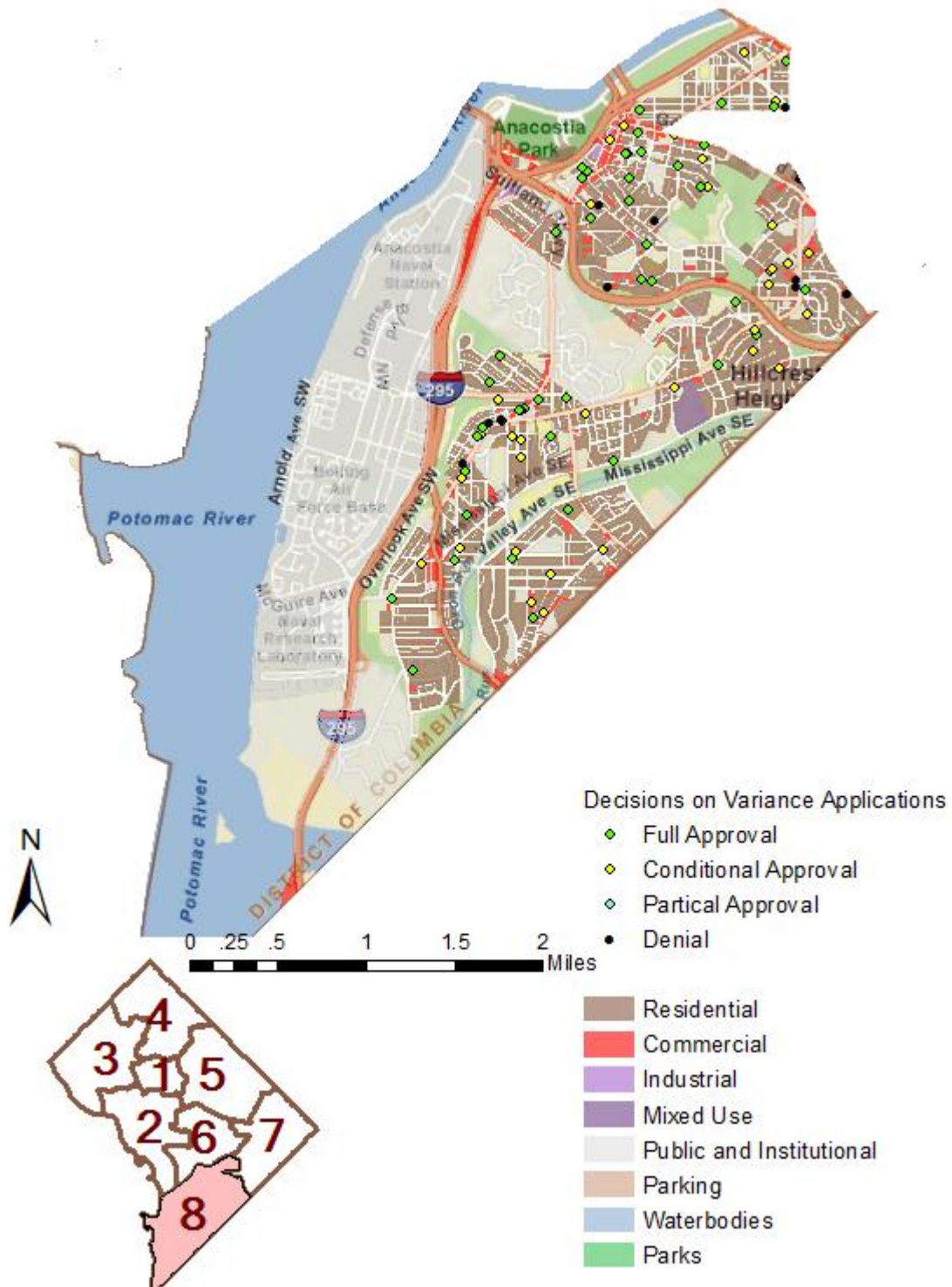
Figure 5-25. Distributions of variance applications and decisions in Ward 8 from 1980 to 2009
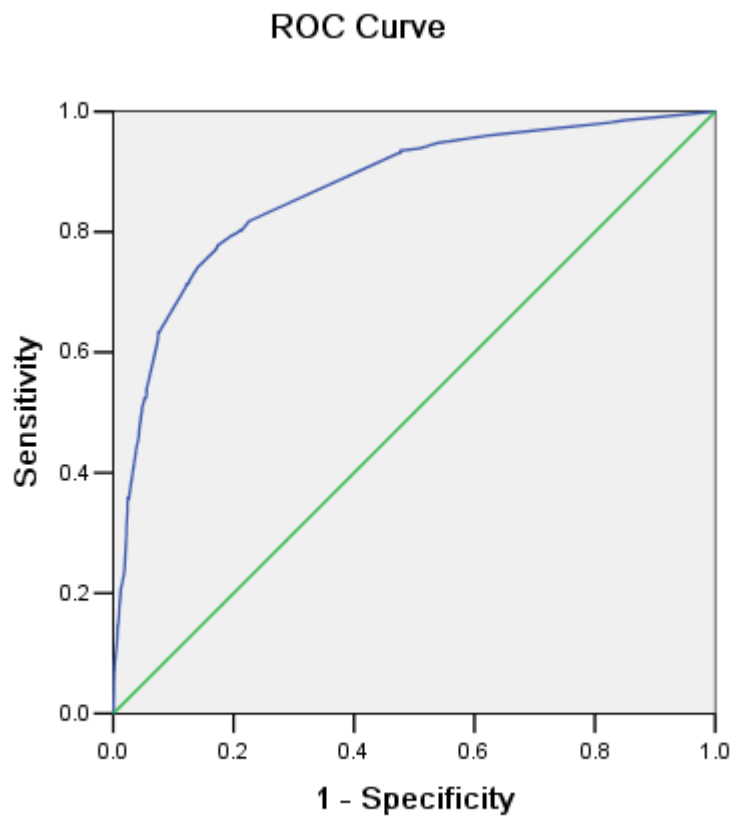
ROC Curve

Diagonal segments are produced by ties.

Figure 5-26. ROC curve

Legend

Variance Application Hot Spots

High : 9.22452

Low : -3.15527

Washington D.C. Boundary

World Street Map

Waterbodies

Parks

Figure 5-27. Map of variance application hot spots
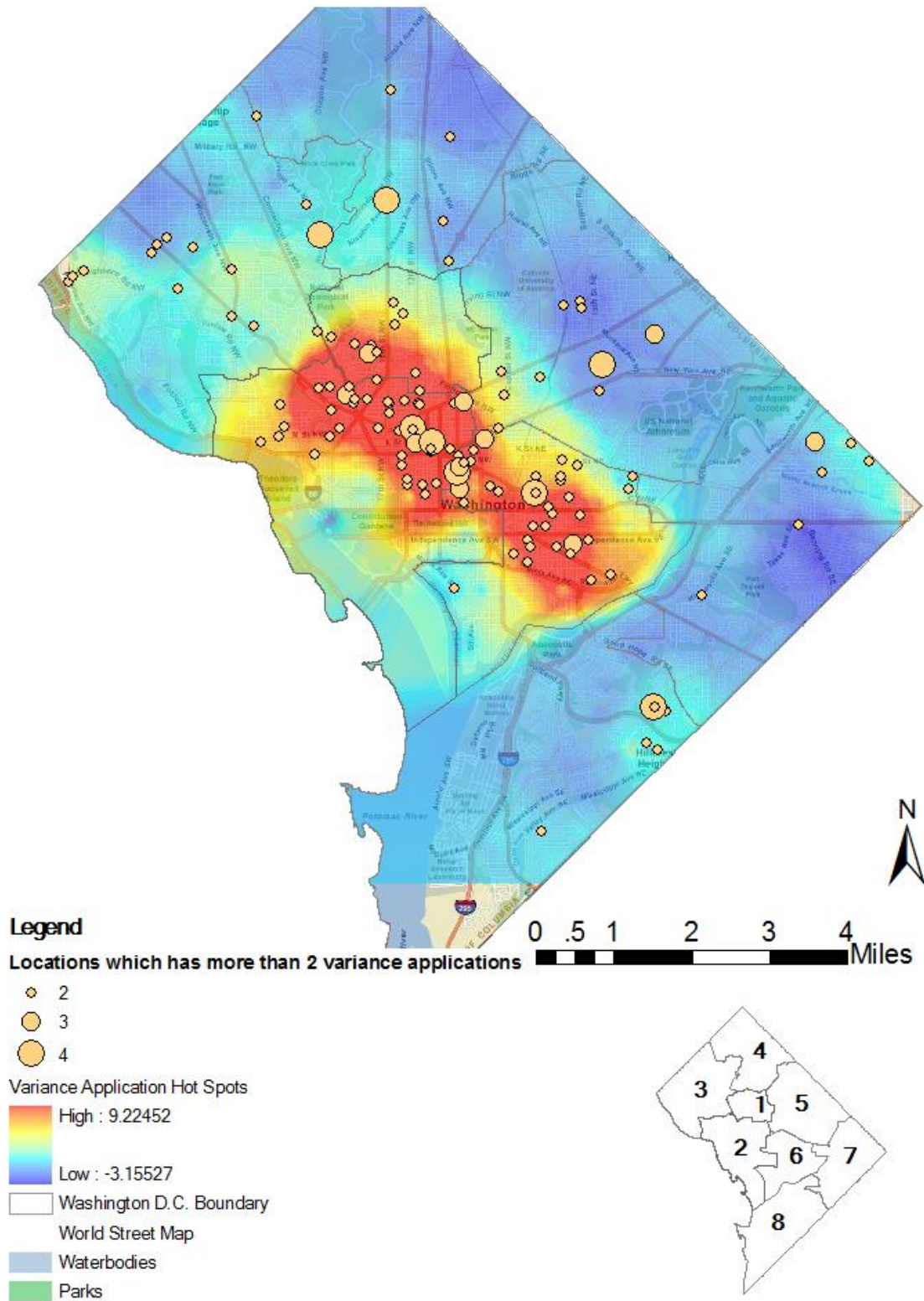
Figure 5-28. Map of locations which has more than two variance applications
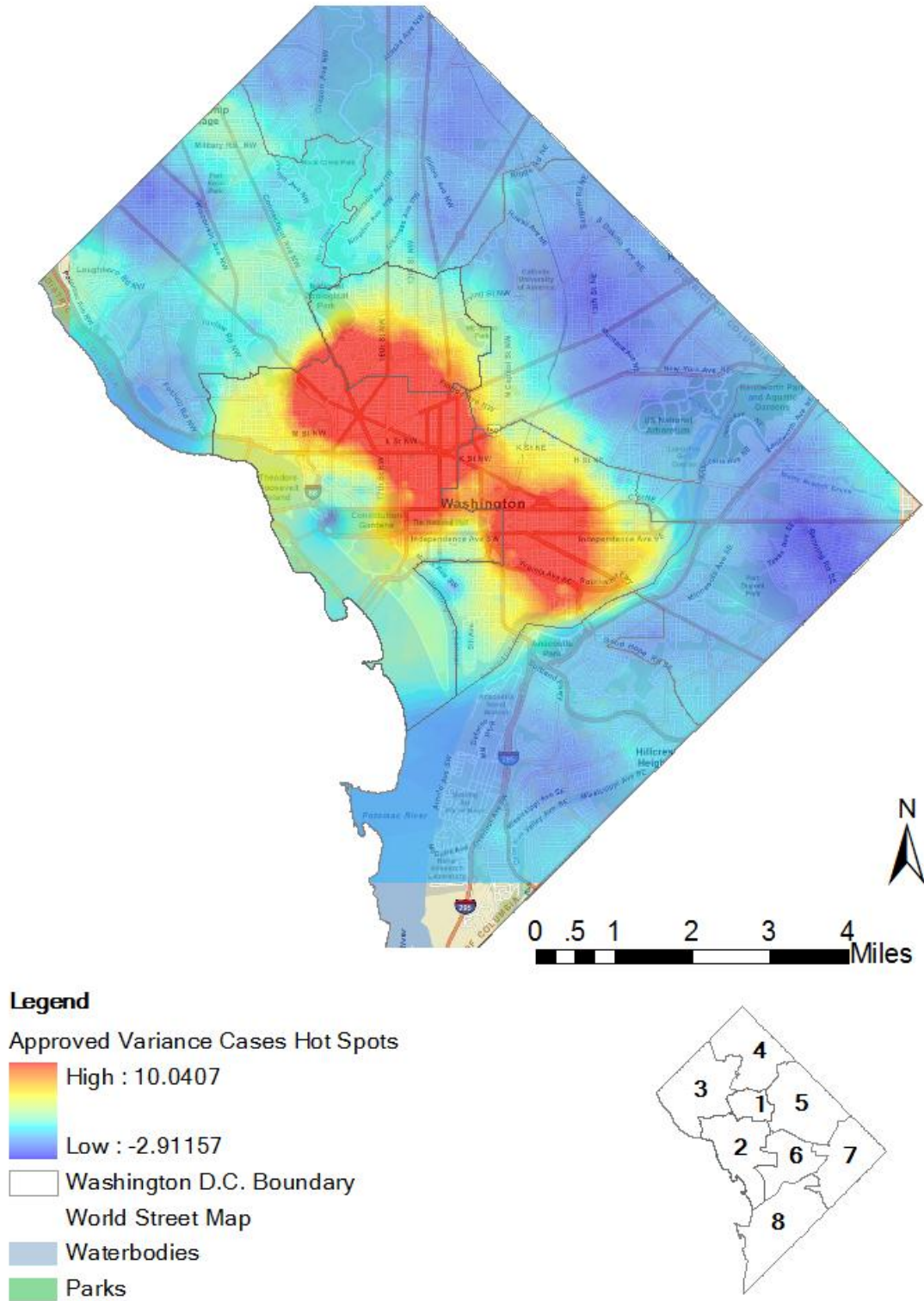
Figure 5-29. Map of approved variance cases hot spots

CHAPTER 6
CONCLUSIONS AND RECOMMENDATION FOR FURTHER RESEARCH

Summary

Zoning variance is a widely applied tool in the United States for land use

regulations, which "perfect[s] a crude regulatory instrument," and "prevent[s] what would

otherwise be an inflexible, unreasonable, arbitrary application of zoning ordinance"

(Owens & Brueggemann, 2004, p. 283). Guided by the general criteria for granting

zoning variance stated by state/local legislature, the board of zoning adjustment plays

an important role making final decisions based on the exact situation of property. Since

zoning variance is a "violation" of zoning ordinance, the "power of variation is to be

sparing exercised and only in rare instances and under exceptional circumstances

peculiar in their nature, and with due regard to the main purpose of a zoning ordinance

to preserve the property rights of others."[1]

However, some researchers have noticed that in practice the board is too lenient

to the applicants and the rate of approval remains very high ("Building Size, Shape,"

1951; Reynolds, 1999). Moreover, discrepancies between theory and practice appear in

terms of the factors which affected board's decision. The community's attitude towards

the variance application is thought to be a very important factor affecting the BZA's

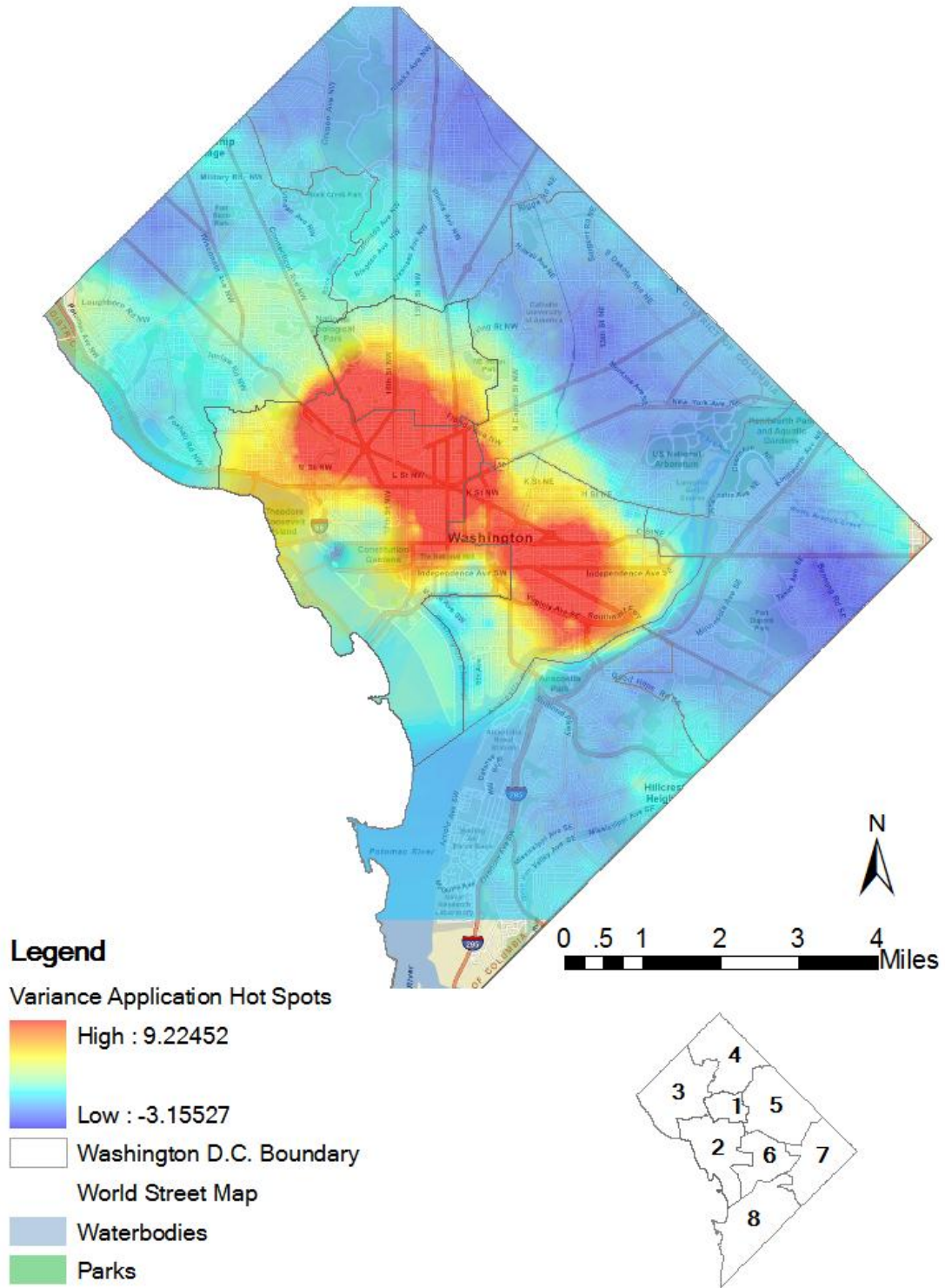decision making, especially regarding the reaction of opponents ("Administrative

Discretion in Zoning," 1969; Leary, 1958; Madry, 2007; Shapiro, 1969; "Zoning

Variances and Exceptions: The Philadelphia Experience," 1955). Some researchers

indicate that the BZA is reluctant to grant use variance compared to area variance

(Burke & Snoe, 2004; Salkin, 2008). Some states require the BZA to place great weight

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[1] Hammond v. Bd. of Appeal, 154 N.E. 82, 83 (Mass. 1926)

on other public agencies' reports and recommendations when reaching a decision. However, findings show that public agencies have a limited influence on the BZA ("Administrative Discretion in Zoning," 1969; Dukeminier & Stapleton, 1962; Owens, 2004; Shapiro, 1969).

This dissertation has attempt to examine the factors which affect zoning administrative bodies' final decision making on variance applications, as well as to analyze the trends of variance application and determination from the perspective of time dimension. Based on existing literature, four hypotheses were proposed by the author. The first hypothesis was about the general situation of zoning variance decisions: Hypothesis 1. Granting of variance applications is significantly higher than denial. The other three hypotheses are concerned with the possible factors which were identified according to existing literature. They are: Hypothesis 2. Opponents from affected neighborhoods influence the zoning administrative board's decision making; Hypothesis 3. Type of variance application affects the BZA's decision making; Hypothesis 4. The zoning administrative board does not place significant weight on suggestions from other public agencies during decision making.

To assist in answering these research questions and testing the four hypotheses statistically, a case study was conducted. The author collected and compiled 2140 variance cases decided by the Board of Zoning Adjustment in Washington D.C. from 1980 to 2009. The author conducted a comprehensive analysis of variance applications and decisions from the BZA in Washington D.C. in the following aspects: variance applications, decisions from the BZA, area variance approval, use variance approval,

the Office of Planning involvements, the ANCs' involvements, the community involvements, use of properties requested for zoning relief, and variances by ward.

Hypothesis 1 was tested using the Binomial Test. Hypothesis 2 to 4 were tested in the basic binary response model developed by the author.

The results provided us with comprehensive information and assisted the author to come to conclusions about the above four hypotheses. The results of the Binomial Test showed the distribution of dichotomous (approval and denial) data is not the same as the expected distribution – 50% each. Considering that the average approval rate is much higher than the average denial rate, the author came to the conclusion that the granting of variance application is significantly higher than the denial.

The results of the basic binary response model show that the type of variance, recommendations from the Office of Planning, recommendations from the ANCs, opponents present at public hearings and opposition from other public agencies did affect the BZA's decision significantly. The model indicates use variance application is 1.978 times more likely to be denied by the BZA than area variance application; the variance application is 2.916 times more likely to be denied when there is an opponent present at the public hearing when no opponents present at the hearing; the variance application is 24.4 times more likely to be denied when the OP opposes the application than when the OP supports the application; the variance application is 5.5 times more likely to be denied by the BZA when the ANCs oppose the application than when the ANCs support the application. The model predicts that 65.8% of variance applications would be denied by the BZA when there are other public agencies opposing the

applications. However, statistical analysis shows that support from other public agencies does not make any difference in the BZA's decision making.

In summary, the OP exerted the strongest influence in affecting the BZA's decisions on zoning variance applications. The second strongest factor influencing these decisions is the support or opposition offered by the ANCs. This finding is in accordance with the zoning ordinance in Washington D.C. The input of OP and the ANCs assist the BZA in making a fair decision. The influence of opponents present at the public hearing is weaker than recommendations from the OP and the ANCs, yet it is stronger than type of variance and recommendation from other public agencies (the OP and the ANCs are excluded from the other public agencies).

The setting of ANCs is peculiar in Washington D.C. Not many cities in U.S. have similar public agencies in the process of zoning variance. Compared to individuals' opposition, the opinions of ANCs which are composed of local residents are less biased. Their stance is not concerned with personal benefits. Rather, they are more interested in the cost and benefit of the whole community.

Besides the above factors which were tested in the basic binary response model, the author conducted further investigation on other possible factors that might also affect the BZA's decisions, including property area, land value, existing type of property (residential, commercial, mixed use, other), and type of variance applicant (individual, firm, other). These variables were added into the basic binary response model and tested by statistic methods. The statistic results showed that with the exception of land value, other variables did not affect the BZA's decision significantly. The larger the land value is, the less likely that the BZA denies the application.

The clustering of zoning variance is a spatial representation of the increment of variance in time dimension. Researchers have found evidence for the clustering of variances which might lead to further granting of variances or rezoning. One of the major concerns expressed by some scholars is that it would alter the characteristics of the community and lead to the invalidation of zoning ordinances. On the other hand, it might also signify that the community is no longer suitable for existing zoning function. It is necessary to determine whether variance applications are spatially clustered as a result of 30 years' accumulation in Washington D.C., one of the fundamental questions in this research.

The author applied hot spot analysis in ArcGIS to investigate whether the concentration of variance applications and approved variance applications exist in Washington D.C. The results show that for variance applications, cluster exists in Washington D.C. The concentration of applications was more intense and some variance applications occurred in the same location, especially in the center of the District (where CBD is located). The results also reveal that the residential properties are relatively more stable than commercial properties in terms of conforming to zoning ordinance under the condition that the location had previous zoning variance application. As mentioned above, the clustering of variances may signify that the functions of the zone may no longer be suitable for the area and rezoning is needed for the area. Planning measures need to be taken in the center of Washington D.C. to address the increasing needs for functional change. Especially in commercial areas, where applications for variance concentrated, other land use tools may be applied instead of zoning variance to insert more flexibility and vitality, essential for local economic

development. The clustering of approved variance applications is similar to that of variance applications, which implies that there was no apparent bias from the BZA's decisions. The spatial concentration of granted variance stems from the spatial concentration of variance applications.

This research provides a new method to researchers and practitioners from both the legal field and urban planning field to better understand the situation of zoning variance applications and decisions in the United States. Compared to previous research, this study is innovative mainly in the following aspects:

(1) This research is from a planning researcher's point of view concerning the issue of zoning variance. Instead of focusing on how practice is diverges from theory, this study focuses more on the affecting factors. How do these factors affect the BZA's decision? What role do urban planners play in this process? How zoning variances are spatially represented and what is the inner meaning of local community?

(2) It is the first time that the statistical model is applied to the research area of zoning variance based on solid and reliable long-range data. Applying statistical analysis in the social sciences has the following advantages: scientific, objective, and replicable. Besides, the model also shows how, and to what extent, the identified factors affect the BZA's decision, which was not discussed in the previous studies.

(3) The spatial analysis on the distribution of zoning variance applications and decisions could be a tool for urban planners to monitor the spatial demands of variances and elaborate on how those variances change the local characteristics. In addition, the concentration of variances might be an indicator that the area needs more flexibility under existing land use regulation.

Implications to Planning and Law

Previous studies on zoning variance mainly came from the legal field, most of which focused on how practice in zoning variance diverges from theory. However, as an indispensable part in zoning and comprehensive planning, zoning variance is considered by urban planning researchers. This missing part of research from the planning perspective, which is supposed to be the connection between legislation and social practice, might lead to an even larger divergence between theory and practice in zoning variance. It is not sufficient to simply judge whether practice is divergent from theory. The essential questions are how to make regulations fit in with the rational needs of society. The rationality and reality of the factors which affect the BZA's decision should be noted and reviewed.

It is a long-range and complicated project in identifying the factors affecting the BZA's decision and understanding why they become factors. How are these zoning variances spatially distributed and whether these changes influence the local community? If the influence exists, is it positive or negative? The load is too heavy for planning practitioners to assume this project. Urban researchers should take the responsibility in answering the above questions under the assistance of planning practitioners to provide regulation makers with solid ground. Regulation makers take the responsibility to establish reasonable regulations and ensure that they are implemented effectively.

This research is the first step to setting up a replicable method to identify the facts and situations in zoning variances. The statistical method could be applied to different areas to identify the situation of zoning variance administration and the affecting factors in the BZA's decision. According to the results drawn from the case study in Washington

D.C., the author proposes the following questions to law makers and urban planners for further discussions:

(1) How do we view the high approval rate of zoning variance applications?

Many studies criticize the BZA as too lenient in accepting variance applicants. This stance views the BZA as "disobeying" the rule of zoning variance. However, this high approval rate is common across the United States. If it is a problem, the BZA should not be the only agency to be criticized. Profound ineffectiveness of policies and regulations may exist within this body. Or there is another possibility. The BZA may be is doing exactly what society needs.

(2) How to view the residents' opinions?

Public hearing is a channel to allow cross examinations between variance applicants and other parties including residents. The results in this study show that the BZA is significantly affected by the opponents appearing in public hearing. The variance application is 2.916 times more likely to be denied when there is an opponent present at a public hearing than no opponents being present at a public hearing. However, there is no explicit requirement by the zoning ordinance that the BZA should give credence to opponents from the community in its decision making. Though most ordinances require that the variance must not be contrary to public interest, safety, and welfare, it is hard to say whether the present opponents indicate that the variance application is contrary to public interest, safety, and welfare. On the other hand, neglect of opponents' opinions is inadvisable either. It might depend on the BZA's better judgment. The main issue is that there is no legal basis. How to view the residents' opinions and how to handle the

degree that opponents' opinions affect the BZA's decision are questions for both planners and law makers.

(3) How to maintain the independency and fairness of the BZA?

This study shows that the land value might be another factor which affects the BZA's decision. The higher the land value is, the more likely the application is granted. It is unknown what inner reason leads to this result. It might be that the owners of properties with high land value are capable of hiring experienced attorneys. Since the burden of proof is partially on applicant, applications with complete preparation might be more likely granted. However, if the cause comes from economic power, affecting the committee members' judgment, measures should be taken to preserve the independency and fairness of the BZA.

The complication of land use decides that the theory and practice in zoning and zoning variance are not simple. In order to have zoning variance ordinance and the BZA better execute their social functions, practitioners and researcher from both planning and legal fields should cooperate with each other.

Recommendation for Further Research

Zoning variance research is an interdisciplinary research project which requires knowledge of urban planning, land use law, public administration and economic development for a complete comprehension. This dissertation is a beginning to the author rather than a finale. Lack of complete data and funding, and lack of the author's experience in practice have limited the depth and scope of this research. More information needs to be acquired and more efforts are needed for a comprehensive understanding of the BZA's decision on zoning variance. In the future, improvements can be made in the following aspects:

First, as shown in Table 5-5, the Nagelkerke R Square is 0.406 in the basic binary response model. 59.4% of the BZA's final decisions could not be explained by this model. In the section on "Further Investigation", the author analyzed some other possible factors that might affect the BZA's decisions. The land value was identified as another factor. However, due to the limitation of data availability and the method conducted in this research, some possible factors were not tested. As indicated previously in Chapter 3, two methods can be used to collect data regarding the determination zoning variance. The first method is to summarize zoning variance cases during a period based on the official documents. Using the date, researchers could investigate the relation between the BZA's decision and other factors (e.g., arrival of protestors and letters of opposition from neighborhood, type of application. The second method is via survey. The surveyors dispatch questions to the administrative officials and related agencies. Using this method, some information that cannot be collected by the first way are made manifest (e.g., officials' knowledge of planning, engineering, and architecture, attitudes towards protestors, and other public agencies). The ideal approach is to combine the aforementioned methods. This research applied the first method and did not conduct a survey. More factors affecting the BZA's decision might be found if a survey were present.

Second, the author selected Washington D.C. as the study area to investigate the BZA's decision on zoning variance applications. It has been explained in Chapter 3 why the author selected this city. The four hypotheses were tested using the variance data in Washington D.C., and the author came to conclusions based on these data. In order to

know whether those conclusions are prevalent across the United States, the author needs more time to study other areas.

Third, in Chapter 5, the map (Figure 5-27) shows the areas where variance applications concentrated. The occurrence of locations where variance applications spatially concentrated coincide with high economic activities and development activities may reflect some inner causal relationship between economic activities and variance applications. It is a question which needs more information for further research.

Fourth, in the further investigation section in Chapter 5, the author found that land value is another factor which affects the BZA's decision. However, since the data for land value did not cover all 2,140 cases, 1,301 cases which have data on land value were used for statistical analysis. Due to limitation of data availability, the results in that section might not fully represent the facts. In order to get more reliable results, the author should use complete data and examine this factor again.

Fifth, this research utilized a single case study approach. The findings on Washington D.C. cannot be directly applied to other cities. The boards' decisions in different jurisdictions may be affected by different factors. Therefore, the conclusion is not intended to be regarded as a universal finding. In order to determine whether some factors have the same impact on the board's decision in different cities, the binary response model needs to be applied to other cities in future studies

Apart from the aforementioned issues which should be addressed in the further research, the author will design a conceptual framework to integrate existing and newly developed land use tools effectively in land use system. The discrepancies between the theory and practice of zoning variance indicates that the traditional land use

tools/regulations no longer satisfy the social needs in this rapid changing world. Presently, it is difficult to create a brand new land use tool, which can address land use issues better than the traditional zoning system. The integration of existing and newly developed land use tools may allow more flexibility without losing the essence of land use planning.

APPENDIX A
CRUDE BINARY RESPONSE MODEL

The software SPSS was applied to run the crude binary response model, which included all ten independent variables. The method of forward stepwise (Wald) was applied to eliminate the variables not significant at 95% confidence level. This method runs 9 steps to get the variables which affect dependent variables statistically significant. In each step a new variable is added[1].

Table A-1 shows the significance, parameters of each variable, Wald test and the odds ratio (Exp(B)) of the model. The sixth column "Sig." provides the significance of each variable. At the 95% confidence level, except the variable of "support from communities", all other variables passed the Wald test and were included in this model.

Omnibus tests verify whether the model with a new added variable is significantly better than the model without a new added variable. Table A-2 shows the results for each step of the binary response model. The "Sig" column shows whether the model with new added variable in each step is better than the model in the last step. As indicated, from step 1 to step 9, each model with a new added variable is better than the model in last step. Step 9 has included all the variables except "CRSupport". The variable for other forms of community's support does not affect the BZA's decision significantly and it is excluded from the binary response model.

Table A-3 shows the -2 log likelihood statistic and the coefficient of determination R Square. The first column of "-2 log likelihood" decreases from step 1 to step 9 and the R Square in both the second column of "Cox & Snell R Square" and Nagelkerke R

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[1] The sequence entered by the variables does not affect the final results. In this model, the sequence is as follows: step 1: CRNoation, Step 2: OPSupport, Step 3: OPNoaction, Step 4: ANCSupport, Step 5: ANCnoaction, Step 6: Use, Step 7: HearingOppose, Step 8: OASupport, Step 9: OAOppose

Square" increases from step 1 to step 9. These indicate that the model with new added variable in each step is improving at predicting the BZA's decision than the model in last step.

R square in OLS regression measures to what extent a model can explain the dependent variable. "In logistic regression, there is no true R^2 value as there is in OLS regression". (Newsom, 2010, p. 1) The Cox & Snell R square and Nagelkerke R square are two methods to represent the function of R square in OLS regression. The larger the value is, the more the model explains the dependent variable. However, the maximum value of The Cox & Snell R square is less than 1. Since Nagelkerke R square ranges from 0 to 1, it is preferred in model explanation. In step 9, the Cox & Snell R square is 0.238 and Nagelkerke R square is 0.416. This indicates that the independent variables in our model can explain 41.6% of the BZA's final decisions.

Hosmer-Lemeshow test is used to test the overall model fit. The null hypothesis is employed so that the model fits the data well. As shown in Table A-2, in step 9 the Sig<0.05, which means the null hypothesis is rejected. Although in the Omnibus tests nine variables were included in this model, the model does not pass the Hosmer-Lemeshow test, which means the model should be adjusted. Notice that in Step 5, Step 7, Step 8 and Step 9 the Sig<0.5, multicollinearity might exist in this model. Since all the independent variables are dummy variables, multicollinearity is common in this kind of model. By applying the Pearson test, the author obtained the correlation significance and eliminated two more variables: OASupport and CRNoaction. Both variables are significant in the original model, which means that they affect the BZA's decision significantly. However, since they are correlated to other variables, they include both the

causes that bias prediction. On the other hand, the correlation shows that the views between other public agencies are consistent with that of the Office of Planning. The output also shows that no other form of action from the community is negatively correlated with opposition in public hearing. This outcome is also reasonable, implying that the number of cases which had support from the community was so small that it can be safely neglected in the model. Furthermore, for the cases in which opponents appeared at a public hearing, other forms of opposition from the community might also take place.

Table A-1. Significance and parameter of crude binary response model

Variable	B	S.E.	Wald	Sig.	Exp(B)
Use	0.657	0.183	12.962	0	1.929
OPSupport	-3.091	0.222	193.072	0	0.045
OPNoaction	-2.298	0.181	160.419	0	0.101
ANCSupport	-1.652	0.229	52.217	0	0.192
ANCnoaction	-0.805	0.212	14.479	0	0.447
HearingOppose	0.667	0.215	9.664	0.002	1.948
CRNoaction	-0.663	0.193	11.846	0.001	0.515
OASupport	-0.925	0.378	5.971	0.015	0.397
OAOppose	0.645	0.323	3.983	0.046	1.906
Constant	1.257	0.261	23.207	0	3.515

Table A-2. Omnibus tests of model coefficients by step

		Chi-square	df	Sig.
Step 1	Step	141.754	1	.000
	Block	141.754	1	.000
	Model	141.754	1	.000
Step 2	Step	103.927	1	.000
	Block	245.680	2	.000
	Model	245.680	2	.000
Step 3	Step	222.476	1	.000
	Block	468.156	3	.000
	Model	468.156	3	.000
Step 4	Step	53.951	1	.000
	Block	522.108	4	.000
	Model	522.108	4	.000
Step 5	Step	26.656	1	.000
	Block	548.764	5	.000
	Model	548.764	5	.000
Step 6	Step	13.107	1	.000
	Block	561.872	6	.000
	Model	561.872	6	.000
Step 7	Step	10.236	1	.001
	Block	572.107	7	.000
	Model	572.107	7	.000
Step 8	Step	6.864	1	.009
	Block	578.971	8	.000
	Model	578.971	8	.000
Step 9	Step	3.875	1	.049
	Block	582.846	9	.000
	Model	582.846	9	.000

Table A-3. -2 Log likelihood and R square by step

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1677.816(a)	.064	.112
2	1573.889(b)	.108	.189
3	1351.413(a)	.196	.343
4	1297.462(b)	.216	.378
5	1270.805(b)	.226	.395
6	1257.698(b)	.231	.403
7	1247.462(b)	.235	.410
8	1240.598(b)	.237	.414
9	1236.723(b)	.238	.416

a Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.
b Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

APPENDIX B
CATEGORIES OF VARIANCE REQUESTED

Table B-1. Categories of variance requested

Category	Category 1	Category 2
Lot		lot occupancy
		lot width
		lot area
		rear yard
		front yard
		side yard
		lot subdivision
		theoretical lot
		second principle structure on a single lot
		number of buildings in the same lot
Building	Principal Building	height
		story
		floor area ratio
		gross floor area
		roof structure setback
		number of roof structures
		arcade
		penthouse
	nonconforming building	nonconforming structure
		addition
		enlarge nonconforming building
	Accessory Building	structure
		height
		story
		accessory structure floor area ratio
Court	open court	width
		area
	closed court	width
		rear yard
		area
Parking		parking
		parking space location
		size of parking spaces
		off-street parking
		number of off-street parking
		accessory parking space
		paving materials

Table B-1. Continued

Category	Category 1	Category 2
Street		street frontage
		street wall
Alley		alley width
		alley structure height
		alley set back
		building on alley lot
Location		district boundary
		location of gasoline service
		location of accessory use and building
Space		residential recreation space
		residential open space
		ground level public space
		maneuvering and accessibility space
		retail space
Loading		loading berth
		loading space
		off-street loading facility
Other		antenna
		structural change for community service center
		number of persons in rehabilitation home
		timing of combined lot development
		landscaping
		entrance
		access aisle
		transferable development right
		driveway

APPENDIX C
HOT SPOT ANALYSIS

This part presents the theory of hot spot analysis and its application on variance applications and decisions cluster analysis.

Figure C-1 shows the statistic model of hot spot analysis. For each location, the model returns a value called Z score. "A high Z score and small p-value (probability) for a feature indicates a spatial clustering of high values. A low negative Z score and small p-value indicates a spatial clustering of low values. The higher (or lower) the Z score, the more intense the clustering. A Z score near zero indicates no apparent spatial clustering" (ESRI, 2009).

The purpose of using hot spot analysis in this research is to determine whether cluster of variance applications and decisions exist. To identify cluster, we focus on a relatively larger scale rather than individual cases. By combining the nearby cases occurring in a certain distance, we get the aggregated data which we assume happened in the same location. In this study, 200 feet[1] was used as the threshold distance. The second step was to count the number of cases which occupied the same locations by using "collect events" tool under Spatial Statistics Tools – Utilities Toolset. Then the author applied hot spot analysis with rendering under ArcGIS Spatial Statistic Tools – Rendering Toolset. Figure C-2 shows the map of Z score of aggregated variance application. For a better view of cluster, the author applied Inverse Distance Weighted tool under Spatial Analyst Toolbox and obtained Figure 5-27. The interpretation of the

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[1] In zoning variance application, it is required to inform owners of property within 200 feet of the site.

color on the map was explained under the section Clustering of Zoning Variance in

Chapter 5.

Hot spot analysis for approved variance applications also applied the same

process as that of variance application.

The Getis-Ord local statistic is given as:

$$G_i^* = \frac{\sum\limits_{j=1}^{n} w_{i,j} x_j - \bar{X} \sum\limits_{j=1}^{n} w_{i,j}}{S \sqrt{\dfrac{\left[n \sum\limits_{j=1}^{n} w_{i,j}^2 - \left(\sum\limits_{j=1}^{n} w_{i,j} \right)^2 \right]}{n-1}}}$$

where x_j is the attribute value for feature j, $w_{i,j}$ is the spatial weight between feature i and j, n is equal to the total number of features and:

$$\bar{X} = \frac{\sum\limits_{j=1}^{n} x_j}{n}$$

$$S = \sqrt{\frac{\sum\limits_{j=1}^{n} x_j^2}{n} - (\bar{X})^2}$$

The G_i^* statistic is a z-score so no further calculations are required.

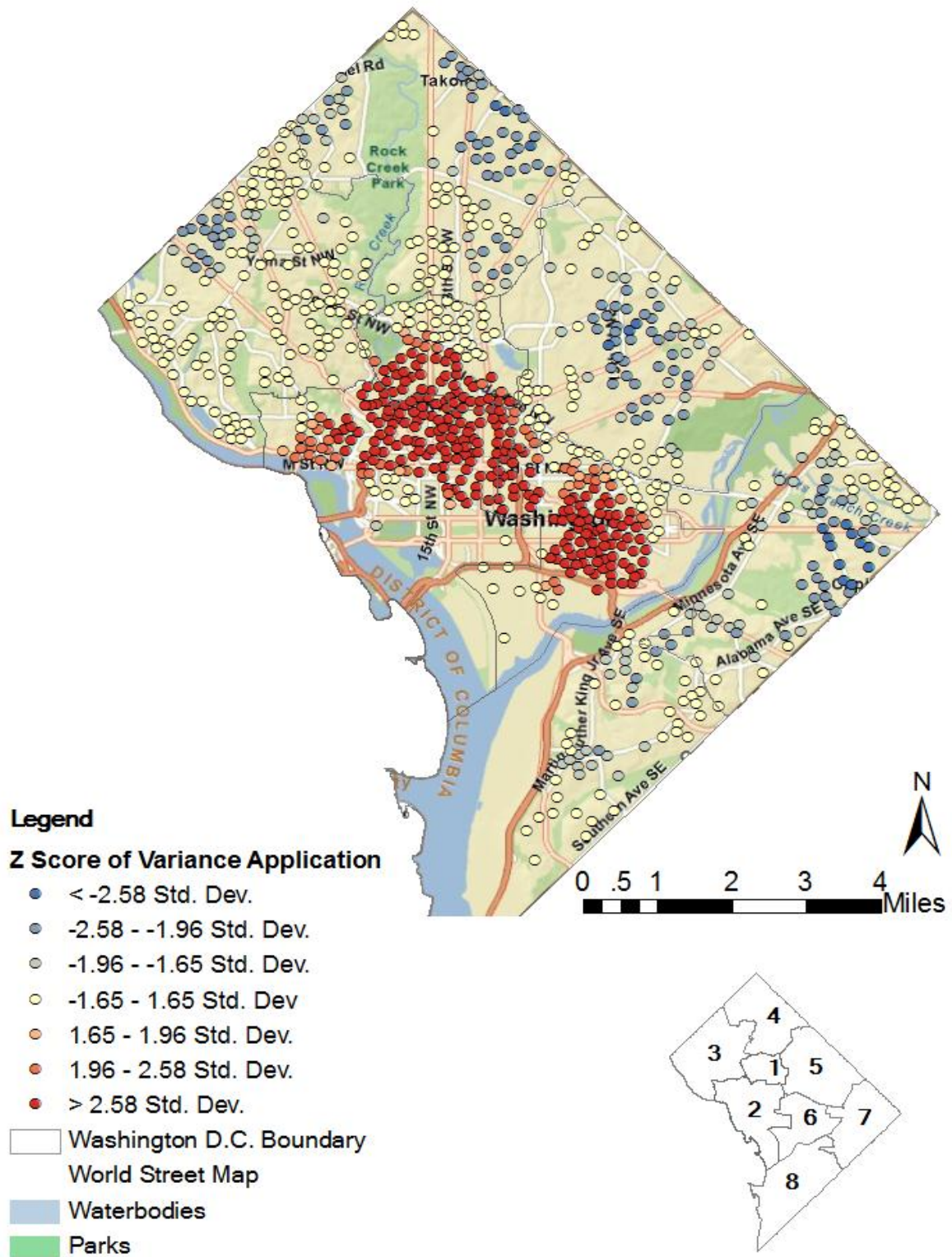Figure C-1. The statistic model of hot spot analysis[2]

Figure C-2. Map of Z score of aggregated variance applications

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