SHARED LAND USE IMPACTS BETWEEN MILITARY INSTALLATIONS AND CONTIGUOUS COMMUNITIES (POST-BRAC): FACT AND OPINION DIFFERENCES IN PLANNING AND PUBLIC POLICY

by

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ABSTRACT

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How a policy or planning tool (e.g. BRAC) contributes to real and perceived conclusions from policy implementation is the main focus of this research. This research examines differences between real and perceived encroachment issues and concerns through study of military installations and their contiguous communities using post-BRAC opinion data compared to conclusions drawn from pre-BRAC and post-BRAC empirical data. A study of six (6) supporting research topics from current literature leads to a hypothesis that there are no differences between the same variables using empirical data (reality) and opinions (perception) with respect to variable

descriptors of encroachment in the post-BRAC time period. Study expectations are that there is no difference between real impacts and professional opinions (e.g. military and civilian) from policy implementation. This study investigates whether professional opinions are related to the reality of communities. It is expected that professional planning opinions are accurate. Also, the study adds to urban planning knowledge about differences in real and perceived planning information, and discloses community and military base associations with regard to urban policy and community planning.

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INTRODUCTION

1.1 Synopsis

Land use adjacencies and differences are issues in many planning jurisdictions. This research examines the impacts and differences between real and perceived encroachment concerns by examining military installations and their contiguous communities resulting from federally initiated base adjustments of the post-BRAC (1989-2007) time period. The post-BRAC time period is defined as the time period after the federal public policy (program) was enacted. Real, contrasted with perceived, planning issues have been somewhat muddled in the literature, and deserve this further study.

The following research questions form the theoretical foundation for this study:

1. Are planning and policy professionals correct in their policy-making assumptions and reactions to policy implementation or are policy changes driven by perceived reactions to probable consequences of wide-ranging policies?
2. What are the time-related physical, social and economic encroachment impacts of a policy tool (e.g. BRAC)?

3. What are the types and collaboration levels between military and civilian master planners? How do communication and collaboration impact professional perception?

4. What land use impacts or other changes relate to population density and/or the population of installations and their communities?

There is a history of contiguous cities, themselves, and military base installations complaining about the others' encroachment impacts; therefore, this subject of study can clarify the theoretical basis that lies at the root of developing goals and objectives for master planning efforts. For the purposes of this study, encroachment is defined as building and land development that interferes with military mission operations or military growth and conversely, military operations that impact urban and suburban areas of their contiguous cities.

Perceived encroachment differences are measured by post-BRAC opinion data obtained from military and civilian master planners including 1) types of encroachment, 2) level of encroachment, 3) condition of collaboration and communication efforts, and 4) utilization of encroachment mitigating planning tools. Actual levels of encroachment are measured and developed as encroachment indicators from current literature, government documents, census data, DoD records, planning regulations (military and civilian), research studies, Army Knowledge Online (AKO), and additional reports. Encroachment indicator data was gathered for both pre-BRAC (1970-1988) and post-BRAC (1988-2007) time periods.

The research determines: 1) differences between perceived and actual levels of encroachment of both installations and their contiguous cities during the post-BRAC period, 2) base and community physical conditions at the time of program initiation compared to after implementation, 3)findings about types of encroachment, 4) links between an installation's development influence and different types of land use encroachment, 5) measurable communication and coordination relationships between military planners and their civilian counterparts, 6) types of plan implementation tools (or regulations) most often used to alleviate encroachment issues.

1.2 Concept Statement

This study defines differences between observable (factual or real) encroachment and perceived encroachment between military installations and their contiguous communities during the post-BRAC time period. Encroaching installations and communities are viewed as containing locally unwanted land uses (LULUs), an academic subject of importance to planning.

The study concerns both urban encroachment by military mission activities (e.g. troop training, munitions testing, flight training, firing ranges, maneuver training), and military encroachment on urban areas that produce health, safety, and welfare issues, such as dust and noise. For the purposes of this study, encroachment is defined as existing conditions of: 1) military observable variables that interfere with urban and suburban areas of cities; and 2) local government observable variables that interfere with government military mission operations. Throughout this research the term community is defined as both incorporated cities and unincorporated places contiguous to a military installation. The term installation is used to describe all military installations, bases, depots, plants and camps.

BRAC Legislation began in 1988 and had been authorized by Congress to reorganize military installations to be able to more efficiently and effectively train, house, and mobilize troops to maintain mission readiness. Since the BRAC process began in 1988 there have been four additional series of closures and realignments (1991, 1993, 1995, and 2005). These five (5) BRAC reorganizations may have stimulated both rapid growth for some installations and mission reductions for others. Encroachment issues have been perceived in areas that experienced a high rate of growth and mission and operational increases.

When BRAC required mission increases, it potentially impacts the contiguous civilian communities in four key ways, the: 1) natural environment, 2) built environment, 3) socio-cultural environment, and the 4) economic environment. BRAC policy impacts the natural environment through increasing development and pressures that additional development puts on natural (air, water and land) resource consumption. The built environment includes all facilities, housing, training spaces, transportation systems, and infrastructure systems that support military missions. An increase in the built environment impacts the natural environment as well as the quality of life of the community. The built environment also serves the socio-economic community by providing places for employment, housing, transportation and access to natural resources. Mission increases from BRAC implementation also impacts the socio-cultural aspects of a community. A population gain means increased interaction between military and civilians as they use the same community resources (e.g. schools, parks, cultural resources, libraries). The military installation has an authoritarian structure that "makes claims on all aspects of a member's life" (Lutz 2001, 197) and regulates the lifestyle of those associated with the military installation, which in turn affects the social structure of the community as well. A military community must deal with huge turnover rates from deployment and changes in missions. Military individuals and their families are never in one place for long, meaning that the community population constantly changes. The presence of a booming military installation can also create an incentive for retired military families to locate in a military community.

Finally, an increase in military missions directly impacts the local economy. A population increase intensifies the demand and supply of local housing stock within the community. A rise in population will increase the level of community resource use. Soldiers who live on an installation pay no property tax to communities but still use community resources such as parks, schools, emergency services, roads, and other public infrastructure. This situation becomes an economic burden for the off-base community. New missions also mean employment opportunities for both military and civilian labor forces. The military is male dominated (women only make up approximately 14% of the military) (Lutz 2001, 191), which has an economic impact because men typically earn more than women, which indicates a higher than normal household income. The military has an egalitarian pay scale that provides for a relatively high average income. This income is approximately 12% higher than the household national average (Lutz 2001).

The natural, built, socio-cultural, and economic environments of the military installation directly impact the community "outside the fence”. Continuous communication and strong collaboration is essential for the installation and community to be good neighbors. Encroachment issues are perceived in areas that are experiencing a high rate of growth and mission and operational increases. Whether or not these encroachment dilemmas are real or perceived is the main aim of this study.

From past records, communication memos (Army Knowledge Online 2007) relate that cities view military activities as a nuisance and mission operations often pose a risk to the health and safety of a community. Contiguous communities and military installations have not had collaborative planning relationships; each one planning in their own self-interest. Even though current literature proves synergy in professional relationships (Martin et al. 2005) is an essential component to collective planning, military and civilian planners still do not communicate beyond the fence. Under the current conditions of DOD Transformation and BRAC 2005 many military planners and their civilian counterparts are facing encroachment dilemmas because of the fast rate of growth and change and a lack of collaboration toward a common goal.

1.2.1 Purpose of Study

This dissertation clarifies the dependent (or independent) relationships between military installations and their urban neighbors and determines what extent public policy implementation produces real or perceived encroachment. Contiguous communities that do not have military installations may well gain from the findings of such a focused study. Survey research (self-report questionnaires) provides opinion data about the perceived effects of encroachment and background information about intergovernmental communication relationships between military installation planners and their urban planning counterparts. The study discloses if a relationship or relationships exist between the opinions of military and community planners and the empirical data of encroachment variables. Such findings contribute to academic knowledge and professional practice in an area of study that has been understudied.

1.2.2 Significance of Study

This research is an important academic area of research because of the fast rate of building development and change for both military installations and military communities; and because such a study provides important data and explanatory information for community planning and urban public policy. Also, programs and policies in general, have been lacking in adequate evaluation and measurement of effects (HUD, EPA).

Research done from both the military and the surrounding community's perspectives explains post-BRAC physical impacts and collaborative conditions. There is limited research that compares real and perceived impacts from policy implementation. There has also been limited research that considers both military and civilian perspectives. Therefore, this study adds to a research area that has been previously understudied.

This study is environmentally important because changes in urban physical form may be found to produce negative environmental and ecological impacts on military land areas. The military protects many natural and cultural resources that are adversely affected by urban development. Military installations have been deemed ecological “islands of diversity”, and are harmed by outside growth pressures (Van Antwerp 2001).

Finally, this study is significant because findings are expected to disclose the relationship between the opinions of military and community planners and empirical data of encroachment indicator variables. Such a study adds to planning knowledge about differences between real and perceived planning information, and discloses community and military base relationships with regard to urban policy and community planning. This research also captures the inter-governmental relationships between military installations and their surrounding urban areas after public policy implementation (BRAC).

1.3 Theoretical Overview

Military planning techniques are similar to the typical, rational planning methods. The military realm is driven by political decisions, funding, and current missions (e.g. war, peace-keeping, state-of-emergency). It is this last issue, current missions, that sets military planning apart from civilian land use planning. The research is approached from two diverse perspectives: 1) military master planners working within the rational planning paradigm, and 2) community (civilian) master planners practicing ad hoc planning or the “muddling through” city planning approach (Lindbloom 1959).

Military planning, which is rational in nature, is typically a top-down approach with limited public participation. The rational planning theory paradigm attempts to establish a general public interest that is impartial and representative of the interest of an entire community. Rational planning can be defined as a means-end analysis with the main actions of: 1) goal-setting, 2) establishment of policy or planning alternatives, and 3) implementation of preferred or accepted alternative (Banfield 1973). In rational planning, “an end is an image of a future state of affairs towards which actions are oriented … formulation of the end may be extremely vague and diffuse” (Banfield 1973).

The military master planner is concerned with two different rational planning approaches in making land use planning and policy decisions. The first approach is mission sustainment. This approach implies that the military makes land use decisions based on the requirement of fulfilling a mission. In other words, development decisions are need driven by what it takes to complete a military mission (e.g. war, peace-keeping, police action, combat readiness). Missions are the reason for the militaries existence; and the Army has two fundamental missions, operation and institutional.

Operational missions are concerned with “numbered armies, corps, divisions, brigades, and battalions”, whereas institutional missions are concerned with providing “the infrastructure necessary to raise, train, equip, deploy, and ensure the readiness of all Army forces” (us.army.mil 2007). Simply stated, operational missions cannot be achieved without institutional missions, and institutional missions are non-existent without operational missions. Therefore, land use planning is seen in the military as being an institutional mission that must be carried out in support of an operational mission. This approach to land use planning ensures military planning is efficient and functional.

Another approach to military land use planning and policy decision-making is capabilities-based planning. This planning concept is based on four principles, including 1) broaden the range of missions for which forces are prepared, 2) make joint service perspective prominent in all aspects of planning, 3) use risk as a strategic measure for effectiveness, and finally 4) shift requirements away from requirement generation to innovative concepts and approaches (Joint Systems and Analysis Group 2007). Capability planning focuses on what a military installation needs rather than what it already has. Capability planning is "planning, under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances while working within an economic framework that necessitates choice" (Davis 2002, 2). Capability planning also "attempts to move away from suggesting solutions too early in the process (in the) aim of delaying a decision or narrowing options (to) encourage the development of more innovative alternatives" (Joint Systems and Analysis Group 2007, 4).

Since the implementation of BRAC and DoD Transformation, there has been a shift away from traditional military rational planning approaches. Military installations and surrounding communities are beginning to understand the importance of collaborative planning initiatives. Both military installations and communities understand that, because of close proximity, what impacts one also impacts the other. In contrast to rational planning, collaborative planning is an approach that is inter-jurisdictional with multi-agency involvement. In collaborative planning, stakeholders are involved throughout the entire process; whereas in rational planning involvement is limited to important milestones. Collaborative planning is also based on the practices of information sharing and open communication. Trust and good relationships between collaborators are established by open communication and involvement in the decision-making process (Schilling 2006). Open communication is much easier in today's society of partnering, networks, and easily accessible information (Castells 1996, 1997); where "differences in knowledge and values among individuals and communities are growing, and where accomplishing anything significant or innovative requires creating flexible linkages among many players" (Booher and Innes 1999).

Collaborative planning is a type of communicative approach which focuses on "design of governance systems and practices, focusing on ways of fostering collaborative, consensus building practices" (Healey 1997). Before collaborative planning techniques are implemented, practitioners must have a thorough comprehension of policy-making institutions. When planners understand the institutionalized behavior that is naturally embedded in military and community policy-makers, one can better understand how to communicate and cooperate when making land use decisions. Institutionalism "emphasizes the social relations through which collective action is accomplished, producing public policy discourses and relational resources through which material and cultural benefits are developed, and activities regulated" (Healey 1997). Collaborative planning is the "integration of the dimensions which must be addressed in any attempt at the collective management of common concerns about co-existence in the shared space of urban regions" (Healey 1997), and offers a chance for a shared-power world (Bryson and Crosby 1992) in which all stakeholders have involvement into the decision making process. Collaborative planning also offers discursive practices to build an "institutional coherence, through which shared problems about the way urban region space is organized can be collectively addressed" (Healey 1997).

This research is approached from a collaborative planning perspective due to the recent need for military and local communities to collaborate and communicate in order to reduce encroachment impacts. The research, with the use of a web-based survey, affords the opportunity to determine if this new collaborative planning approach is proving to be an effective and realistic approach to improving the relationships between military installations and their community counterparts.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature falls into two categories, military and academic, although few non-military researchers have focused on military planning because of the ever-changing nature of military initiatives (Van Antwerp 2001, Poppert 2001). The literature review examines and integrates six key research areas. These research areas are included in the literature review because of their valuable connection to the study. All six of the research areas help to capture the muddled association between real and perceived policy impacts and the intergovernmental relationships that shape the perceived opinions. The six research areas include: 1) academic literature on the economic relationship(s) between military installations and their surrounding communities (military-community complex), 2) topics dealing with similar relationships (e.g. community-industry, community-university), 3) current trends in impact analysis and encroachment mitigation, 4) locally unwanted land uses (LULUs), 5) population density and urban planning, and 6) a review of the social psychology of planning policy decisions and the reciprocal relationship between public policy implementation and public opinion.

2.2 Economic Influence of Installations

The first review examines the economic relationship between military installations and their surrounding communities. Although military installations impact the social and cultural aspects of their surrounding cities, the economic interaction and planning collaboration between the two defines their physical form (Hooks 2003, Markusen 1991). This literature also relates to non-military but economically biased local governments in that they have an economic relationship that affects the form, function and social construction of the surrounding community.

Within military communities there is a military-industrial relationship which is a "defense-led innovation, which often produces economy-altering spin-offs, different from all previous innovation in capitalist history" (Markusen 1991, 33). The military-industrial relationship also affects local economic development because "the presence of few competitors reinforces the tendency toward agglomeration by encouraging firms to cluster together" around military installations and research and development centers (Markusen 1991, 36, Deger 1986). Even though military spending has decreased significantly since the Cold War (Davis and Ward 1992), it still is a driving force behind local and regional economic development and policy decisions. The seminal work on the economic impact of defense spending is Benoit's "Growth and Defense in Developing Countries" (1978), which proposes that the "defense burden is positively correlated to growth rates…the chain of causation is such that a high defense burden causes the growth rate to rise" (Deger 1986, 179).

The relationship between military cities and their installations is not only based on location. Military installations depend on the federal government for defense spending, and in turn communities and their support industries depend on the money generated from military installations. The relationship between the military installation and its community consists of what sociologist Sam Marullo identifies as the five sides to the "iron pentagon" (Lutz 2001). These five stakeholders include military contractors, the Department of Defense, weapons laboratories, the Congress, and military support industries, also described as the military-industry complex (Anderson 1982). This last side of the iron pentagon is the most important as it is "defense-led innovation, which often produces economy-altering spin-offs, different from all previous innovation in capitalist history" (Markusen 1991, 33, Atesoglu and Mueller 1990). The military-industrial relationship also affects local economic development because "the presence of few competitors reinforces the tendency toward agglomeration by encouraging firms to cluster together" around military installations and research and development centers (Markusen 1991, 36).

2.2.1 Community Spillover

Military installations not only impact local economic systems by providing employment, but also through the spillover effects on local industries (Deger and Sen 1983, Deger 1986). Defense spending aims to "develop, produce, test, and maintain state of the art armaments," (Hooks 2003, 229, Mehay and Solnick 1990) so that the United States remains technologically advanced. In the quest for advanced weaponry, the United States has furthered aerospace, mechanical and electrical engineering and communication industries (Anderson1982, Lutz 2001, Mehay and Solnick 1990). Since the 1960s there has been an increase in research and development dollars (Atesoglu and Mueller 1990), which "reflects the increasing emphasis on a smaller military force wielding high technology weaponry" (Hooks 2003, 232). "Science and industrial programs generate spin-off technologies that spark fast growing industries, and growth in economic activity has been higher in regions housing these installations" (Hooks 2003, 229)

This industrial growth does not provide as much employment to a community as one would believe (Mehay and Solnick 1990). In fact, war machines and weapons have become so technologically advanced that they "no longer use the mass production, assembly line manufacturing processes of the older war industries" (Lutz 2001, 175). Military industries are now using fewer highly skilled and highly paid employees to support the military (Atesoglu and Mueller 1990). Many researchers believe this reduction has caused an inequality gap within military communities, while others deem that this creates a flatter class structure for a military community (Deger 1983, Lutz 2001).

Some research concludes that defense spending displaces personal investment and consumption (Russett 1969, 1970, Atesoglu and Mueller 1990). Other studies have determined that defense spending has displaced other governmental spending which could be used on welfare, health and education policy spending (Davis and Ward 1992). For example, "military spending has produced fewer jobs per dollar than other kinds of government spending: A billion military procurement dollars create 26,000 jobs while the same amount in health care creates 37,000, and in education 48,000" (Lutz 2001, 174, Anderson 1982). The difference in job creation levels is because military research and development usually requires a more highly skilled and trained workforce. The military "recruits a highly educated and well-paid labor force and aggressively pursues technological innovation" (Hooks 2003, 229).

Technology impacts a military community's economic structure by the location of nearby support industries. Support industries locate close to military installations for several reasons, including:

- easy access,
- low transport costs,
- quick distribution of production,
- easy communication,
- and to keep an eye on competing firms/industries (Lutz 2001, Markusen 1991).

Another reason industries locate close to the military installations is that in the military-industrial complex there are few competitors which "reinforces the tendency toward agglomeration by encouraging firms to cluster" (Markusen 1991, 36, Deger and Sen 1983).

Communities are also affected by the commercial cash flow provided by high populations of military personnel and their families. Military personnel are different from civilian workers because of their lower cost of living. Often, military personnel are young with "low rates of savings" and the lack of "consumer needs associated with establishing a new household" (Lutz 2001, 171). This indicates that individuals usually spend more money on non-basic needs (e.g. restaurants, entertainment, clothing, sports and leisure). The higher commercial spending gives officials in military communities a false sense of economic security. Many residents and officials in communities feel protected from the typical highs and lows of economic fluctuations, giving the impression that they live in a "recession-proof city, a safe place to make a living because federal cash pour in ceaselessly" (Lutz 2001, 172). However, the excess money military individuals spend is dependant on federal government funding which means a community's economic health is tied to defense spending decisions (Dardia 1996). When the defense budget increases the community's economy is considered "good", without regard to the condition of their other economic sectors (e.g. housing) (Bradshaw 1999).

A military community may get support aid from the federal government for economic burdens from the installation. Many communities with military installations that are poised for closure or realignment due to BRAC legislation receive government assistance in order to defer some of the economic impact of the change (Dardia 1996, Glassberg 1995, Poppert and Herzog 2003).

Base Realignment and Closure (BRAC) legislation also has an important impact on the economic state of military communities. There are conflicting research findings about the extent of negative impacts due to BRAC (Bradshaw 1999, Dardia 1996, Glassberg 1995, Poppert 2001). One set of research findings (Bradshaw 1999) indicates that base changes aren't necessarily positive or negative. There are several factors that affect the impact level including:

1. community population size,
2. level of economic diversity within the community (Poppert 2001),
2. type of redevelopment planned for the installation, and
3. potential reuse based on necessary environmental cleanup (Bradshaw 1999, Dardia 1996).

In summary, existing research suggests that military installations impact the economic activity of their surrounding communities. However, researchers disagree to the extent of this impact. Ultimately, economic influence depends on many factors, including:

- extent of military presence,
- community size,
- level of economic dependence on the community,
- state of other economic sectors within the community,
- level of dependence on installation for technological research and development, and
- level of dependence on installation for employment (Bradshaw 1999, Deger and Sen 1983, Glassberg 1995, Poppert 2001).

2.3 Military-Community Partnerships

Military installations are dependant on the federal government for funding and policy creation. A community, as defined in this dissertation, is a creature of the state and therefore follows a completely separate set of political rules. Academic journals offer limited research on the military-community complex. Therefore, topics dealing with similar relationships (e.g. community-industry, community-university) are the second area of research covered in the literature review.

The university-community relationship is similar to the military-community relationship in many ways. The first commonality is that both the university and the military impact the economic system of the community (Baum 2000). Another similarity is that both have communication issues, as both the university and military are self-focused and concerned with their own success (Chatterton 2000, Glassberg 1995). Both the university and military have a different set of policies and rules that they follow that are distinctly different than that of other groups residing in their surrounding community. Much of the existing literature attempts to capture the complex relationship between the university and the community as well as provide creative ideas on how to bridge the communication gap between the two partners. Much of what has been learned from the university-community partnership can be applied to military-community partnerships, which makes the university-community complex an important relationship to include in this literature review.

The seminal article, Bridging 'Town & Gown' through Innovative University-Community Partnerships (Martin 2005) outlines success factors for university-community relationships. The most important success factor in this type of partnership is funding (Glasson 2003, Martin 2005). Many different organizations and agencies are willing to fund university-community partnerships as long as "the role funders are to play during implementation (is) defined early and clearly" (Martin et al. 2005, 9). Funding is also an issue in the military-community complex. Communities rarely have extra funding available for additional partnership ventures and federal funding for collaborative planning is difficult to acquire. Many federal funding grants are increasingly competitive and follow a lengthy award process (Visser 2002). Another factor that is crucial to the success of a community-university or community-military partnership is communication. Communication is important to ensure the partnership is able to "identify problems and challenges, discuss expectations, and develop professional relationships" (Martin et al. 2005, 9). Synergy is also an important component because a collective planning endeavor is more advantageous than an individual effort (Hafner and Miller 2008). When partners collaborate toward a common goal, the outcome is greater.

Another important success factor is having a measurable, highly visible outcome (Martin et al. 2005). Findings that are easily accessed (e.g. via the Internet, mail-outs) are more likely to be implemented. Big, bulky reports are not readily accessible to a large group of stakeholders and prove tedious to search through for the findings (Mandell 2001, Schilling 2006). Martin et al. 2005 suggest using more concise and effective means of reporting findings (e.g. academic articles, PowerPoint, GIS, and newspaper articles). Technology can also be used to promote successful partnerships. Easy access to information via the Internet (e.g. blogs, web casts, chat rooms) not only allows for the sharing of information but also saves time.

Another important factor is to keep from forming preconceived expectations of stakeholders (e.g. private practice employees are jaded and government planners are slow and methodical) (Hafner and Miller 2008, Hall 1999). The final factor for a successful university-community or military-community partnership is simplicity. Goals and objectives should be based on realistic outcomes. Partnerships should be "founded on simple modes of operation…explicit goals, common definitions and achievable outcomes" (Marten et al. 2005, 12). These university-community partnership goals can be applied to potential partnerships between military installations and their communities (Glassberg 1995).

There are several important trends changing university-community relationships including "enormous demographic changes in the student body age, financial capacity, and racial and ethnic diversity,…..changed federal funding climate, ….increased funding competition with other needs… and criticism of universities' integrity and commitment to teaching" (Wiewel and Broski 1997, 1). These changing trends alter the relationship between the university and its surrounding community. All of these changing trends appear to apply to military installations and their surrounding communities, too (Loveridge 2002, Glassberg 1995). A military community must deal with high turnover rates from deployment and mission changes. Military individuals and their families are never in one place for long, meaning that the community consistently experiences a change in population composition (Lutz 2001). Military installations and their communities also have to compete for funding from the federal government. There are also many criticisms of a military installation's commitment to the community. There is an historical attitude of general distrust for military installations. Some believe that military installations are too self-interested and historically, “numerous episodes of the American struggle for independence fostered distrust of the military” (Sprout 1948, 264, Glassberg 1995).

A model of administrative behavior that promotes the adoption of a partnership or collaborative model for decision making would provide a “mutual recognition of needs, shared problem definition … a joint search for solutions” (Wiewel and Broski 1997, 2). This type of model would redefine the relationship between partners. The authors conclude that institutions “must engage in partnerships to survive politically and intellectually” (Wiewel and Broski 1997, 7). An example of this type of model is the University of Illinois at Chicago Neighborhood Initiative (UICNI 2007) which was an initiative started in the 1990s and was intended to help improve the relationship between the university and two adjacent neighborhoods. This initiative did not follow the rational planning model, but rather followed an incremental (Lindbloom 1959) and collaborative planning approach. This approach is also promoted by Schön (1983), who proposes that planners be reflective in situations where technical solutions are impossible (Loveridge and Schaeffer 2002).

The UICNI initiative, described by Wievel and Lieber (1998), is a beneficial collaborative model for the military because it proposed four stages to a collaborative planning process. The first stage is the partner’s decision to form a partnership. Each stakeholder (e.g. military, university, industry, neighborhoods) has different motivations for joining a partnership. The second stage is the building of trust among stakeholders and the developing of planning process and methods. The UICNI initiative completed a survey that showed that the neighborhoods had little trust in the nearby university because of past planning decisions (e.g. the destruction of houses for expansion of the university). This lack of trust is also evident in a community-military complex (Sprout 1948). The establishment of trust is essential to form a lasting partnership (Martin et al. 2005). The survey also showed potential partnership matches between university specialties (e.g. architectural students) and neighborhood needs (e.g. revitalization). The military-university complex can also benefit from partnership matches. The third stage is the determination of what projects to accomplish during the ten year partnership timeframe. The fourth stage is based on the necessity to make structural changes in order to strengthen the partnerships.

Wievel and Lieber (1998) examined the importance of an incremental approach to collaborative planning (Lindbloom 1959). The finding of the UICNI study is that "incremental decision-making allows the relationship to grow, which allows planning and implementation to proceed" (Wievel and Lieber 1998, 16). Wievel and Lieber stress that planners need to use "extensive skills in analysis of political situations in order to understand the motivations and constraints of their partners…and become more adept at communicating and negotiating" (Wievel and Lieber 1998, 17). There are important lessons to be learned from university-community complex, including:

- the importance of leadership and support from top officials,
- effective partnerships take trust and knowledge which is only gained over long periods of time,

- successful partnerships understand each stakeholder brings a unique knowledge and different needs to the partnership, and
- successful partnerships must adapt and change throughout the collaborative process depending on stakeholders and issue or project discussed (Wievel and Lieber 1998).

Qualitative research, based on the work of Paulo Freire who did not believe in a teacher and learner partnership, lends understanding to interpersonal relationships in a community-university complex. Freire believed that the teacher teaches and learns and the learner learns as well as teaches. This means there is a contributing relationship made possible with open dialogue. Freire had four "dialogical tenets of humility, faith, hope, and critical thinking were embodied in this collaborative process" (Hafner and Miller 2008, 66). Research suggests that for open dialogue to enhance collaborative planning structures; those in positions of leadership should ensure fair and open participation (Hafner and Miller 2008, Maurrasse 2001).

Partnerships often experience conflict and hostility due to the assumed neutrality of the universities in real estate and other surrounding land use decisions (Banks 1999, Prins 2005). Prins studied a partnership in California that was born of tension and differing expectations. Collaborative partnerships can offer solutions to urban land use problems by helping to resolve differences in opinions about communication, interaction, policy decision making, and power struggles (Prins 2005). "Unclear purposes and practices lead to confusion, but deliberation and a willingness to learn enable partners to gain understanding and work together more effectively."

Hagen (2002) discusses the importance of community-industry-university partnerships, and points out that universities should be creating new relationships in a time of globalization. Many policy-makers believe universities are an untapped resource. The belief is that "universities aid economic regeneration if they disseminate their knowledge and expertise through industry linked partnerships" (Hagen 2002, 204). The author argues that this is an unrealistic scenario because the relationship involved in this knowledge transfer is complex and not linear. Hagen (2002) describes four "Cs" of partnership success which includes: compatibility, capability, commitment, and control.

Hagen and Harlow (2004) believe that partnership can help develop a strategy to promote international growth. In today's era of globalization, institutions within a community (e.g. industry, military, or university) are expected to produce products to help the global economic stance of their communities. Due to the decrease in public funding, many universities and military installations are turning to private organizations and local industries for partnership opportunities. Universities have needed to "adapt, often with resistance and regret, to the need to seek alternative 'tied' sources of funding from business, industry, civil, society and non-national state action" (Hagen and Harlow 2004, 213). The authors deem this relationship a "knowledge economy", with one partner dependent on the dissemination of a product (e.g. knowledge, employment) and the other partner dependent on the financial resource. This new partnership has the potential to create the belief it is "us against the nation”. These new partnership roles also cause a shift from "government to governance" (Hagen and Harlow 2004, 216).

This is the same for military installations that are now, because of globalization, in a regional relationship with their surrounding communities. Regional because states are of "declining importance…because states are geographically circumscribed but located in an increasingly global community" (Hooks 2003, 227).

2.4 Encroachment/Planning Tools

The third area of research examines literature dealing with military-community encroachment and current planning tools used to improve encroachment issues. Some of these tools are used by the military, while others are planning tools used exclusively by communities for other planning objectives. Academic publications offer limited information regarding encroachment issues and mitigation techniques because encroachment is an elusive, wide-ranging term. As Major General Van Antwerp maintains, "encroachment pressures come from many sources and individually, may not be cause for concern, but collectively, can cause major restrictions to Army training" (Van Antwerp 2001). Many studies have looked at individual encroachment issues (e.g. noise issues), but few have researched combined encroachment impacts or encroachment alleviation tools. This literature review addresses planning tools within the following categories:

1. Collaboration/Communication
2. Technical
3. Land Use Regulation
4. Land Conservation
5. Nuisance Avoidance

6. Military Operations.

2.4.1 Communication Tools

Communication tools help develop trust and open information sharing between the community and the military installation and the "most effective means for strengthening the relationship between the Army and its civilian neighbors is to help people understand how the military operates and why it generates certain impacts on surrounding areas" (Flint Hills JLUS). Open communication is essential to the collaborative planning process (Schilling 2006).

Collaborative planning is built upon the ideas of Habermas' communicative theory as well as institutional geography (Harris 2002). Collaborative planning has an "explicitly normative agenda of developing better (read 'more democratic') planning practices" (Harris 2002, 33). Albrechts and Denayer (2000) believe that collaborative planning should revolve around consensus building that is possible through open communication with stakeholders. They also believe that planners, both military and civilian, have both "multiple realities" and "different truths" about their realities (Albrechts and Denayer 2000, 372-3, Mandell 2001). Healey believes that these embedded realities and truths can only be known through open dialogue that avoids "entrenched positions" and takes into account economic, social and environmental positions (Healey 1998). These positions are "embodied in the attitudes, behaviors, and practices of actual flesh-and-blood planners" (Sandercock 2000, 16). These embedded realities and values cause conflict if open communication is discouraged (Mandell 2001).

Prins (2005) provides a framework for communication for a partnership in conflict. A small misunderstanding, or rather a lack of communication, can destroy important relationships and trust between partners or stakeholders. The underlying problem usually is due to a lack of communication of personal realities, motivating forces, institutional pressures, governing policies, and preconceived perceptions. The stakeholders need to "articulate what their expectations are rather than assuming everyone knows" (Prins 2005, 71). Partners need to agree to sit down and discuss their issues in what Forester described as a "deliberate encounter", so that they might save their partnership (Forester 1999, Schilling 2006). This type of communication "enables partners to work through disputes and, ultimately work together more effectively" (Prins 2005, 72).

Communities and installations can establish methods to help maintain open communication (e.g. monthly status meetings, allowing a military representative to be a non-voting member of the local planning board) (Mandell 2001, Schilling 2006). Open communication, such as public disclosures, allows for the release of information to the public about installation missions and special compatibility issues (e.g. noise, air safety) resulting from testing and training activities. Disclosures also help to decrease land devaluation issues associated with incompatible land uses.

2.4.2 Technical Tools

Geospatial (or Geographical) Information Systems (GIS) offer an important tool to help understand encroachment impacts. GIS can depict “local land ownership patterns, local geography, and local benefits associated with state-level transportation and infrastructure investments" (Westervelt 2004, 12). GIS can identify the attractiveness of land areas near military installations for different types of potential urban development (e.g. commercial, residential), which in turn helps to predict future land use incompatibilities. The attractiveness of a parcel of land is calculated by the following:

- locational relationship to employment,
- low density urban areas,
- housing areas,
- industrial/manufacturing areas, and
- open space and recreational areas (Westervelt 2004, 12).

GIS is able to "more accurately project the pattern of future land use because it considers the regional context of each location more completely" (Westervelt 2004, 14). The following table (Table 2.1: Encroachment Potential from Nuisances) summarizes the technical approaches and benefits to using GIS to project population and land use changes around installations.

Table 2.1 Encroachment Potential from Nuisances

Approach		Benefits
Historic Change:	With GIS, access and display USGS NLCD data	Historic land use facts
Population Projections:	Collect and analyze census tract level data	Historic population facts
Analysis of Land Developer Holdings:	Collect local landowner holdings. May be paper. May be difficult to find and process.	Provides a picture of the intent-to-develop over the next 10–15 years.
GIS Land Use Projections:	With GIS, create growth potential contours and "grow" cities to match population projections.	Can take into account differences in geography.
Urban Growth Simulation:	Like GIS Land Use Projections, with the addition of long simulation runs.	Allows a landscape to evolve – capturing feedback of past growth on future growth.

Source: Westervelt 2004, 18

Technical tools aid planners to make quick, educated land use decisions while still taking into account stakeholder viewpoints, economic realities, and environmental criteria (Joerin 2001, Beinat and Nijkamp 1998). GIS mapping tools allow military and civilian master planners to determine land suitability for placement of locally unwanted land uses (LULUs) and other types of incompatible land uses. When sustainability maps are utilized, it lessens the opportunities for decision making conflicts to arise. GIS maps help with site negotiations and help to aid in intergovernmental collaboration and joint decision making. GIS enables planners to use the multicriteria analysis (MCA) approach to land-use policy decision-making. The MCA approach is based on the

McHargian approach of the placement of appropriate land uses by looking at the exiting attributes and characteristics of land (McHarg 1969). MCA has several advantages including 1) "its non-economic valuation character, 2) its capacity to deal with multiple and conflicting issues, 3) the help it can provide in structuring complex decision problems, thus increasing transparency" (Beinat and Nijkamp 1998, 201). Technological tools that add spatial concepts "supports the structuring of land use problems, allowing the concerns of major actors to be explored, giving trade-offs between conflicting goals, and leading to the evaluation of options from different perspectives" (Beinat and Nijkamp 1998 , 12).

2.4.3 Land Use Regulation Tools

Land use regulation tools allow for the control of land use zones and population density. Traditional zoning tools are utilized to avoid land use conflicts and protect the public from hazards or nuisances. Traditional land use regulation tools are proscriptive versus prescriptive (Katz 2004). Examples of traditional land use tools include:

- land use zoning and density limitations,
- building bulk, set-back limits, height restrictions and shape controls, floor-to-area ratio,
- performance and aesthetic requirements.

Edward Bassett's Standard State Zoning Enabling Act of 1922 gives communities the right to practice land use zoning. Traditional zoning imposes density limitations depending on the land use category and is directly tied to land value. Land that is zoned commercial or multi-family is usually a higher value than low-density single family. LULU (both civilian and military) placement is typically achieved by zoning for nuisance land uses; however, this in turn impacts the surrounding land uses by lowering land values (Popper 1985, Wexler 1996).

Traditional civilian land use zoning designations include residential, agricultural, commercial, recreation/open space, and industrial. Military planners adhere to a similar land classification system with the following additional categories:

- Project Operations – Land that is used for testing, training and all mission operations. Lands that are zoned project operations may also be highly developed (e.g. operations headquarters, maintenance compound) or undeveloped and also used for habitat protection or low-impact recreations.
- Easement Lands – Easement lands are located around project operations lands for protections of the contiguous land use.
- Recreation – Recreation is either intensive (e.g. shooting range, swimming pool) or non-intensive use (e.g. hiking trail).
- Environmentally Sensitive Areas – ESA areas include those areas that require the protection of the integrity of the land (Army Knowledge Online 2007).

Non traditional zoning approaches include form based zoning. Form based zoning methods guarantee a more predictable physical design because they state the expected outcome of the built environment (Katz 2004). Form based zoning codes support mixed-use communities and allow for more flexibility for the landowner by allowing communities to maintain their vision without strict proscriptive zoning.

2.4.4 Land Conservation

Land conservation tools restrict development to protect environmental, historical or cultural elements. Many types of land conservation tools are “contracts (that) compensate landowners for restrictions placed on property rights, and they offer a greater degree of permanence than environmental regulation or land-use zoning plans” (Newburn et. al 2005). Other types of land conservation tools are used to contain urban growth to preserve certain areas. Conservation tools include:

- urban growth boundaries (e.g. UGBs),
- land use buffers (e.g. ACUB),
- open space preservation techniques,
- preservation easements.

Growth management techniques can be used to set limits on the location and rate of urban growth. Urban Growth Boundaries (UGBs) are planning tools used to both control population density by limiting buildable land area within a community and protect land surrounding a community from sprawling development. UGBs have proved successful, preserving 16 million acres of open space (Song 2004). However, many planners believe that UGBs unnecessarily suppress a community’s economic development (Staley et al. 1999). UGBs are also critiqued because of the belief that UGBs only limit residential development. Commercial development pays larger property taxes to a community, so most communities would rather allow commercial development to ensure economic growth. Restricting only residential development has the potential to create exclusionary practices (Downs 1992). UGBs also affect the region surrounding a community. When land prices are too high within a community because of a UGB, people burden other nearby communities with more lenient zoning and growth management policies (Staley et al. 1999).

Land use buffers offer protection from conflicting land uses and also help conserve open space. A paper titled, Compatible Land Use Buffers: A New Weapon to Battle Encroachment discusses a new measure passed by Congress in 2003 that allows partnerships with other private or public entities. This new legislation is Title 10 of the United States Code, Section 2684a, the “Agreements to Limit Encroachments and Other Constraints on Military Training, Testing and Operations”. This measure permits the Army to coordinate with local governments, states, and private entities in order to protect training lands and ranges with development buffers. Army Compatible Use Buffers (ACUBs) are defined as “formal agreements between Army and eligible entities for acquisition by the entities of land or interest in land and/or water rights from willing sellers” (U.S. Army Environmental Command 2007).

Two successful ACUB case studies include Camp Blarding, Florida and Camp Ripley, Minnesota. Camp Blanding, with financial partnering with the Florida Department of Environmental Protection, was able to establish an 8,000-acre ACUB. Camp Ripley partnered with a private organization, Prairie to Pines, to create a 3-mile ACUB (U.S. Army Environmental Command 2007).

The preservation of land in perpetuity has become increasingly important to the health of a community. Non-profit groups are formed to preserve land at a regional level, focusing of preserving historical landmarks, environmentally sensitive areas, or recreation land for public pleasure and education (Urban Land Trust 2003). Countywide strategic plans can also provide direction for open space preservation. Countywide plans encourage coordination between all levels of government for preservation efforts. This is important now that the Army may enter into private agreements with local governments and non-profit organizations. Communities can also preserve open space around installations by entering into agreements with an installation or cooperating with the installation to write a Parks, Recreation, and Open Space Master Plan (Hall and Mertes 1995). Communities may also use development controls in order to preserve open space. Examples of land preservation development controls include:

- Park dedications
- Floodplain dedications
- Clustering of development
- Sensitive lands regulations
- Open space dedications
- Transfer of development rights
- Open space zoning
- Scenic road and parkway designations
- Wetland mitigation banking

- Condemnation.

Contiguous land uses and inter-jurisdictional coordination makes it imperative that the military work with communities and regional authorities to preserve open space as both a land use buffer and for community enhancement. Partnering can lead to joint purchases, agreements and management of public access land.

Preservation easements are quickly becoming a popular planning tool. In fact, the Trust for Public Land estimates that between 1998 and 2001 over $19 billion dollars was spent on preservation easement initiatives (Newburn et al. 2005). Now, with legislation that allows the Army to enter into these types of agreement, it is anticipated that appropriations will continue to increase.

2.4.5 Nuisance Avoidance

Nuisance avoidance tools are usually in the form of easements or buffers of increased distances to separate incompatible land uses. Easements help buffer noise, smoke, dust or other nuisances from the surrounding community (Lust 2004). Figure 2.1: Encroachment Potential from Nuisances depicts impacts from nuisances.

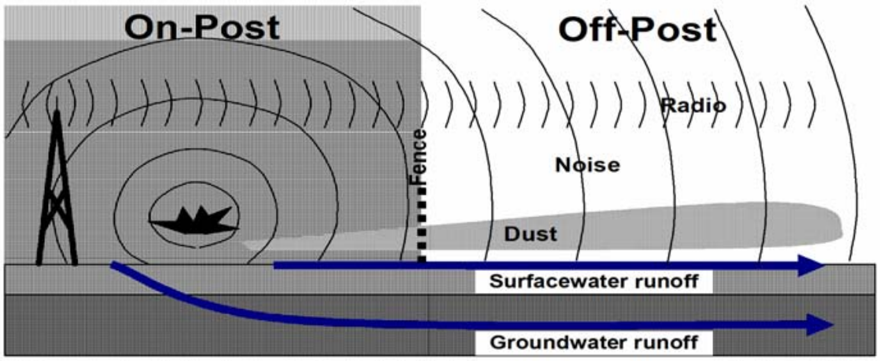

Figure 2.1 Encroachment Potential from Nuisances
Source: Westervelt 2004, 2

On-site noise monitoring can be used to determine noise levels on surrounding communities. Figure 2.2: Urban Encroachment in Noise Contours depicts how noise contours affect surrounding urban communities. Monitoring helps to baseline the noise contours and check accuracy of noise levels.

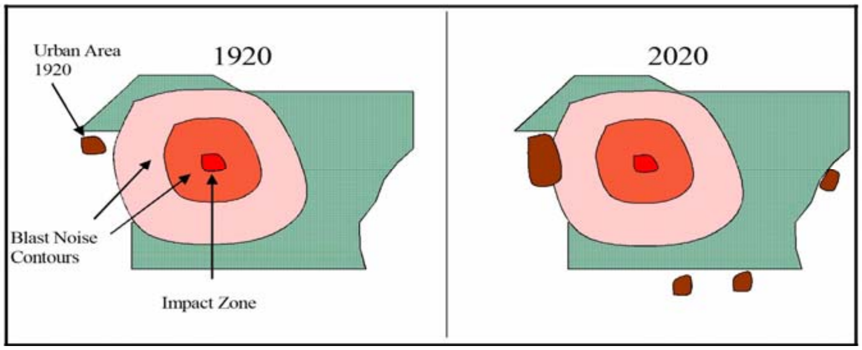

Figure 2.2 Urban Encroachment in Noise Contours
Source: Van Antwerp 2001

Noise is one of the most common nuisance encroachment issues. Noise complaints have forced limitations of demolition training and firing practice. For example, Fort Carson, Colorado, recently had to defend a lawsuit that charged that tank firing noise decreased surrounding land value (Van Antwerp 2001). Research has shown that noise levels can be detrimental to the surrounding population's physical health (State Legislatures 2005). Aside from the mental annoyance, exposure to military noise (e.g. testing, flying) can have impacts on blood pressure and ear systems. A study of several military training areas revealed that "frequencies of ear symptoms (tinnitus lasting more than one hour and permanent hearing threshold shifts of > 30 dB) were higher only in areas where noise levels considerably exceeded 115 dB (A) accompanied by rapid noise level increases" (Hartmut 1990).

Another encroachment issue that has caused training limitations, due to negative impacts, is maneuver training. Maneuver training is constrained at some installations because dust and smoke levels do not comply with local clean air standards. Aircraft training operations also impacts air quality due to increased aircraft emissions when hovering or taking of and landing repeatedly.

2.4.6 Military Operation

Military operations tools help alleviate negative impacts on the community surrounding the military installation. These types of tools modify the operations needed to fulfill training or testing requirements in order to minimize the impact on the surrounding community. An example of a military operation tool is training simulation. Technological advances allow future combat training with simulation systems, but to ensure operational readiness, troops must also receive realistic combat training. Another example of military operation approach would be to limit firing range use during days when weather conditions transmit noise easily (i.e. cold, hazy, or cloudy days). These operational approaches are limited because of the change in warfare tactics. The U.S. Army Environmental Command (2007) discusses the importance training lands and active ranges play in combat readiness. Training activities require a great amount of land to ensure realistic training. Future military combat systems require even more space because with "more lethality and increased range require even larger physical maneuver areas to ensure realism" (Knott and Natoli 2004, 12). Table 2.2: Training Space Requirements depicts historical and estimated future training space requirements for battlefield training operations (e.g. vehicular and aircraft maneuvering, weapons training). Spatial needs for adequate training land has increased from 96 sq km in 1942 to 1,600 sq km in 2003. Future requirement recommendations estimate that future combat trainings require 17,671 sq km.

Table 2.2 Training Space Requirements

Brigade Type	Battlefield Training Footprint Requirements
World War II Brigade (1942)	8 x 12 Kilometers (96 sq km)
Heavy Brigade Combat Team	20 x 30 Kilometers (600 sq km)
Stryker Brigade Combat Team (2003)	40 x 40 Kilometers (1,600 sq km)
Future Force	75-kilometer radius (17,671 sq km)

Source: Knott and Natoli 2004

2.5 Locally Unwanted Land Uses (LULUs)

LULUs are the cause behind the 'not in my backyard' (NIMBY) syndrome. LULUs are defined as a nuisance that is incompatible and even harmful to contiguous land uses. There are many types of both military and civilian LULUs. Military LULUs include: hazardous material testing, live-fire testing, training that harms air quality, training associated noise level, unexploded ordnances (e.g. mines, bullets, bombs), ammunition storage facilities, vehicular and aircraft maneuver areas, and animal retention facilities. Civilian land uses include prisons, waste disposal facilities, landfills, and power plants (Armour 1991).

Traditional land use planning tools (e.g. zoning) seek to place LULUs where the surrounding property values are minimally impacted, both physically and economically. There are critiques with the conventional method of LULU placement. The placement of LULUs is typical approached from the rational planning method which is an “inherently confrontational general methodological framework of the decision-making process” (Armour 1991). A rational planning process does not provide equal and fair communication or collaboration toward land use decision-making and LULU siting. The rational approach to the planning and placement of LULUs also has a sociological perspective. Land use decisions in siting LULUs are often an “emotional, parochial and self-serving community reaction” which causes a community to engage in “organized oppositional behavior to pariah land uses” (Wexler 1996, 91).

Locally unwanted buildings and land uses create problems for military missions and operations. Community attitudes toward unpopular projects make it hard to locate vital military facilities (e.g. munitions testing sites) near developed urban areas. To understand this negative opposition, it is important to note that public opinion is driven by levels of involvement in the decision making process (Dear 1992) in siting these facilities or land uses. LULUs also have a sociological perspective in that they are organized oppositional behavior of a community. This oppositional behavior is propelled into motion by perceived social, economic, or environmental impacts of LULUs within a community (Wexler 1996).

Popper points out that there are several defining characteristic for LULUs. The first is that LULU opposition is usually an organized movement within the community. LULUs also find support within a community if there appears to be local or regional economic benefit to the siting of the LULU. There are also future quality of life costs that may be based on real or perceived impacts (Popper 1985). In this research, there are quality of life concerns for mission realignment for BRAC. Some of these perceived issues include:

1) demand for community services,

2) negative impacts on community infrastructure,

3) health and safety issues relating to military missions,

4) social impacts with the transient military lifestyle, and

5) encroachment from fast rate of development.

Even when military LULUs provide for national defense and security, communities still regularly oppose siting of these land uses because of perceived negative impacts on quality of life.

2.6 Population Density and Urban Planning

In brief, the urban planning profession developed from issues arising from population density. Victorian cities with crowed, diseased tenements propelled the idea that healthier living spaces meant fewer inhabitants. For the working population, low-density living also meant an escape from nineteenth century social unrest. The historical belief was that higher density communities were thought to have negative effects on social attitudes, behaviors (Taylor 1980), as well as the physical health of inhabitants was recorded in writings such as Frederich Engels' The Condition of the Working Class in England and further works by Charles Booth and Charles Dickens. These classic works captured the need for creating a place to live with safer, less crowded, and healthier qualities.

2.6.1 Historical Trends

Ebenezer Howard is known for his belief that cities needed to be a mixture of nature and machine. His classic work, Garden Cities of To-morrow proposed a mixture of town-country with a low population density due to a restriction of 32,000 inhabitants (Howard 1898), Figure 2.3: Howard's Vision of Town-Country.

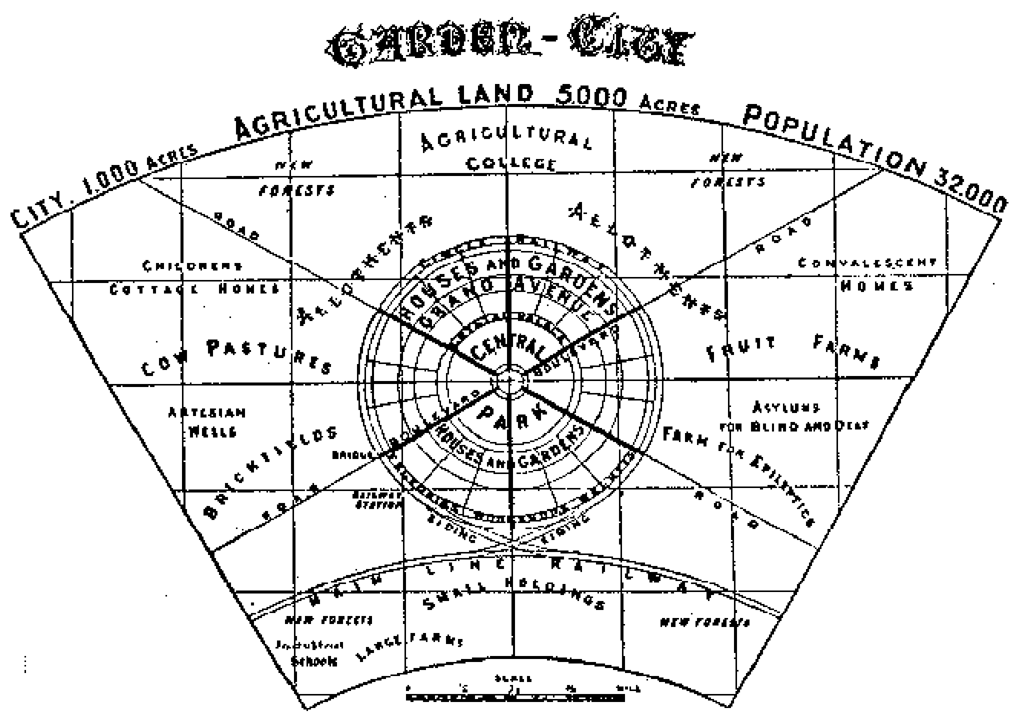

Figure 2.3 Howard's Vision of Town-Country
Source: Howard 1898

The Garden City movement was a precedent for the City Beautiful movement experienced in America from 1890-1940. This movement did not try to move the city to the country, but rather tried to incorporate country within the city. Improving cities through open space would make higher population densities healthier and more aesthetically attractive. According to William H. Wilson's City Beautiful Movement would create several effects:

1. "Social ills would be swept away, as the beauty of the city would inspire civic loyalty and moral rectitude in the impoverished;
2. American cities would be brought to cultural parity with their European competitors;
3. A more inviting city center still would not bring the upper classes back to live, but certainly to work and spend money in the urban areas" (Wilson 1994).

Frederick Law Olmsted, a founding father of the City Beautiful Movement, believed that higher population density cities were overcrowded, noisy and unhealthy unless occupants were given an opportunity to have fresh air and open space. Olmsted sought to remedy the negative public health and societal impacts associated with higher populations by providing open areas and green spaces. With Olmsted's Emerald Necklace as a precedent, many crowded, industrial cities labored to convert their cities from "drab, polluted industrial cores into beautiful and cultural centers" (Harnik 2003). However, following World War II, development of suburbs for America's growing population became the primary focus of policy makers.

After the stock market crash of 1929 and the following economic depression, President Roosevelt created the Resettlement Administration to provide affordable housing (Meriam 1946). The Resettlement Administration created three greenbelt towns that possessed elements from Howard's Garden City movement. However, the majority of affordable suburb developments did not contain the fundamental elements of high density with open space. Instead, these developments were created to be low-density residential areas located away from the city center. This became an era of City Practical, rather than City Beautiful, as most planning and land-use decisions were made in the interest of efficiency.

2.6.2 Current Trends

Thinking has changed since the Victorian era, when high populations were thought the cause of social unrest and disease epidemics. Current research concludes that the health, attitudes and behaviors of a community are not necessarily driven by population density (Taylor and Verbrugge 1980). Less traditional factors such as contiguous and incompatible land uses, housing, land-use patterns, policy decisions, transportation alternatives, urban-design decisions also contribute to the social and economic health of a community (Winsborough 1965).

Inevitably, population density is an important factor in economic development planning. Firms and industries locate where there are higher population densities in order to acquire both higher numbers of consumers and a larger pool of employers. Higher population density increases the need for local services, which reduces the length and occurrences of travel. A denser population indicates a shorter distance between homes, business establishments and community support facilities (e.g. schools, libraries). This denseness affects the entire fabric of the community including the transportation system and land use patterns.

Currently, information advances have made geography less important to accomplishing economic or personal activities. People can tele-commute, attend college courses on-line, and shop without leaving the confines of their personal home. This change in how people connect causes a more sprawling metropolitan fabric (Downs 1999), as people no longer need to live close to employment or centers of activity (e.g. shopping, schools).

Population density has three different meanings: (1) “a macro approach, based on high average densities at the city-wide or even metropolitan level; (2) a micro approach, reflecting high densities at the neighborhood or community level; and (3) a spatial structure approach, emphasizing a pattern oriented to downtown or the central city versus a polycentric (or dispersed) spatial pattern, with obvious density consequences” (Gordon, Richardson 1997).

There are many current planning trends that are founded on the belief that more desirable, livable cities have higher populations (Downs 1999, Taylor and Verbrugge 1980). Current residential planning approaches that encourage higher density levels include: Sustainable Design, Mixed-Use Design, Transit Oriented Developments, Urban Growth Boundaries (UGB), High-Density Zoning, and the Greenbelt/Green Infrastructure Movement. Of these examples, Transit Oriented Developments (TOD) provides the best blueprint to make higher density developments work (Beatley 2004). TODs are mixed use communities that and developed around commercial centers and transit stops. TOD residential housing is located no further than 2,000-foot distance from the transit stop to promote walkable neighborhoods with higher density (Beatley

2004). Urban Growth Boundaries (UGB) are also useful planning tools to let communities designate different density levels for areas inside and outside the boundary. This helps delineate rural and urban development, much like Howard's Town-Country magnets.

Population density literature is relevant to this research because population is the most commonly-used growth indicator nationwide (US Census 2007). Population growth is a measure of the overall social and economic health of a community as well as an important indicator of potential for encroachment. Rising populations indicate an increased demand on local resources, competition for those resources, and a higher potential for encroachment on military installations. Population alone does not give a clear picture of the potential amount of people affected by military encroachment impacts (e.g. training and testing). The size of a community is important, as population density is the number of people per square mile. If a community has a low population but a large land area, fewer people are potentially impacted by encroachment (LULUs). If a community is small in size but has a high population, higher numbers of the population are impacted by encroachment. Therefore, population density and its relationship to planning decisions is an important factor to consider within this research.

2.7 Public Opinion and Public Policy Implementation Literature

This literature review also attempts to determine the impact public policy (e.g. planning policy) has on public opinion. In other words, are policy changes driven by real or perceived reactions to probable consequences of wide-ranging policies? The reciprocal relationship between opinion and policy is important to this research because it studies whether encroachment issues from public policy (e.g. BRAC legislation) are real or perceived and if public opinion, attitudes, perceptions and social psychology play any role in the creation of subsequent policies.

Page (1994) posits that “when opinion and policy correspond, it is extremely difficult to sort out whether public opinion has influenced policy, or policy has influenced opinion, or there has been some mixture of reciprocal processes; or, indeed, whether an outside factor, by affecting both, has produced a spurious relationship (26)." Erikson (1976) studied the differences between public opinion and public policy outcome. In his research, Erikson shows a “reasonable inference that… certain issues-public opinion can exert a strong influence on state policy decision (25).”

The fundamental belief is in a normative democracy, governmental policy is shaped by public opinion (Dahl 1956). Those who view the policy-making process as technical (cost-benefit method, rational planning), believe that public opinion does not play a part in neutral policy-making. For this research, the disagreement about the role opinions play in policy creation is not as important as is the extent that policy shapes opinion. There is a reciprocal relationship between public policy and public opinion after policy implementation. Policy may affect public opinion by “citizens learning about a policy's impact, rationalizing its existence, or heeding the persuasive efforts of politicians, interest groups, or others” (Page and Shapiro 1983, 187).

Some researchers believe that the impact policy has on public opinion is minimal. Page and Shapiro posit “pubic opinion is often a proximate cause of policy; affecting policy more than policy influences opinion” (Page and Shapiro 1983, 176).

Sometimes the level of influence depends on the direct impacts felt by citizens. For example, foreign policy may have minimal impact on individuals, whereas domestic policies, such as BRAC, have direct consequences on citizens employed by the military or living in a military community. Some direct BRAC policy influences include: employment, housing, local economic development, and population changes. Domestic policies affect public opinion greater because the "public presumably tends to care more about matters close to home and is more insistent that politicians follow its wishes on domestic policy…and on foreign policy issues…the public tends to be less involved and have less information, and it might be easier for officials to change policy and get citizens to go along" (Page and Shapiro 1983, 182). Other research proposes that public opinion and policy are spuriously related, both affected by other exogenous factors (i.e. world events, political leadership, interest groups, changes in technology, media interpretation) (Page and Shapiro 1983), and not necessarily causally dependant on each other.

This research leans on the literature of policy analysis originally proposed by Yehezkel Dror (1967) and studies whether a policy is proving effective and predicts the consequences of policy implementation. Policy analyses that are quantitative at times do not probe deep enough to discover the impact on public opinion and in turn lead to further policy creation. In effect, policies lead to the creation of additional policies because sometimes different groups are affected by either real or perceived impacts from policy implementation. Conforming to popular opinion can be strong determinants of public policy adoptions. For instance, when BRAC policy is implemented, installations and their surrounding communities implemented new policies to counteract the effects, whether real or perceived, of BRAC. Ewing (1969) believed that "effectiveness of a planning (policy) largely depends on how it is received by persons in an organization" (Lyles 1982). Planning is concerned with implementation and not necessarily with the social and psychological impact on the individuals affected by the planning policy. "As a result, planning presents a threat to individuals and to existing social orders and ways of thinking" (Lyles 1982, 106). The literature suggests that planning decisions, and the implementation of other domestic public policies, have a direct impact on public opinions and therefore stimulate further policy creation to counterbalance the perceived or real effects of the original policy (e.g. encroachment mitigation policies).

An article by Burgoon (2000) explores the relationships between people's mental state and social dynamics. This research concludes that many of society's social problems can be blamed on the complexity of communication and difficulties with social transactions. Many policy decisions depend on effective social interaction in order to implement the policy and considered successful. However, this research implies that an individual's mental state (e.g. mindful, mindless) has a direct relationship to how they interact in social transactions, which in turn affects policy outcomes (Burgoon 2000).

Another explanation of behavior in the policy-making process is that human behavior is guided by an individual's plans. This indicates that decisions (e.g. policy-making) are guided by the instinctive purposes of the individuals making the plans

(Miller 1960). Some researchers also believe that there is a tie between an individual's purpose (plans) and the knowledge (worldview) they possess. Knowledge is built on a series of images, which by definition is knowledge of what is true to an individual, and is interpreted by past experiences of the individual. An image is the worldview stored by an individual. Knowledge through images is ever-changing and revised based on new experiences and an ever-varying definition of truth and reality. This means that perceptions have a direct tie to the knowledge and reality that individuals create. Images also have a direct tie to policy-making because an individual's perceptions guide their behavior in the decision-making process (Boulding 1956). In terms of this research, images of encroachment are based on the planner's perception and worldview that encroachment is occurring due to changes in or implementation of new policies (e.g. BRAC). This research determines if these perceptions of knowledge are both true to the individual and supported by statistical reality.

2.8 Summary of Literature Review

All six research areas that have been reviewed capture the muddled association between real and perceived policy impacts and the intergovernmental relationships that shape perceptions and opinions. Literature on the economic relationship(s) between military installations and their surrounding communities (military-community complex) helps to understand the strong economic tie between a military installation and their community. The military installation not only provides employment opportunities to the surrounding community, but also impacts its urban form from decisions about other aspects of local economic development. There is a military-industrial relationship with the community, and the community depends on money generated from military installations for its economic health.

Communities and military installations impact each other in non-economic ways as well. The military-community relationship is similar to other relationships (e.g. community-industry, community-university) that affect planning and policy decisions. Military-community relationships face inter-governmental communication issues, as both the university and military are self-focused and concerned with their own success (Chatterton 2000, Glassberg 1995). The community and installation have different sets of policies and rules that they follow that are distinctly different than that of other geographic or political entities residing in their surrounding community. What makes collaborative efforts difficult is that the military and community practice different types of planning approaches. The military practices rational planning driven by political decisions, funding, and current missions (e.g. war, peace-keeping, state-of-emergency); whereas, community (civilian) master planners practicing ad hoc planning or the “muddling through” city planning approach (Lindbloom 1959).

Differences in planning approaches between military installations and their contiguous communities mean they use different types of impact analysis and encroachment mitigation tools. Military and civilian master planners may use any of the following broad types of planning mitigation tools, 1) collaboration/communication, 2) technical, 3) land use regulation, 4) land conservation, 5) nuisance avoidance, and 6) military operations tools.

Many of these encroachment mitigation tools (e.g. zoning) seek to place military and civilian LULUs where the surrounding property values are minimally impacted, both physically and economically. Military LULUs include: hazardous material testing, live-fire testing, training that harms air quality, training associated noise level, unexploded ordnances (e.g. mines, bullets, bombs), ammunition storage facilities, vehicular and aircraft maneuver areas, and animal retention facilities. Civilian land uses include prisons, waste disposal facilities, landfills, and power plants (Armour 1991). These LULUs are usually located where the fewest people will be impacted by the negative aspects of these land uses. Population alone does not give a clear picture of the potential amount of people affected by military encroachment impacts (e.g. training and testing) or community encroachment. Therefore, population and population density and their relationships to planning decisions are an important factor to consider within this research.

Finally, the literature reviews the impacts of public policy (e.g. BRAC) on public opinion. The reciprocal relationship between opinion and policy is important to this research because it provides the theoretical background about whether encroachment issues from public policy (e.g. BRAC legislation) are real or perceived and if public opinion, attitudes, perceptions and social psychology do play any role in the creation of subsequent policies. Therefore, this review of the social psychology of planning policy decisions and the reciprocal relationship between public policy implementation and public opinion is important to this research.

CHAPTER 3

RESEARCH METHOD

3.1 Summary of Research

The following items are discussed in this section: 1) expected findings, 2) research model, 3) statistical research model, 4) self report questionnaire, 5) data sources, 6) sampling, and 7) sample descriptions.

3.1.1 Expected Findings

Findings addressed in this research are: 1) statistical differences in *actual* levels of encroachment between pre-BRAC (1970-1988) and post-BRAC (1989-2007) data, 2) opinion study about the *perceived* encroachment impacts from BRAC policy implementation, 3) findings about *types* encroachment of both installations and their contiguous cities, 4) *linkages* between an installation's development influence and *types* of land use encroachment, 5) measurable *communication relationships* between military planners and their civilian counterparts, 6) types of plan implementation tools (or *regulations*) most often used to alleviate encroachment issues.

3.2 Research Model – Data Analysis

This research examines the differences between perception and reality of the results of impacts from large scale policies and uncovers levels of encroachment.

Data is studied using a six-step process:

1) Categorize and order the statistical pre-BRAC and post-BRAC data using the statistical program, SPSS.

2) Examine statistical data and form conclusions and descriptions about encroachment. Report frequency distributions and variance. Further, study the data using the paired samples T-test to determine if there is a significant change in encroachment indicator variables between pre-BRAC and post-BRAC.

3) Examine data from opinion questionnaires determining perceived positions of military and civilian master planners about the influence of BRAC policy on encroachment in their communities. Provide opinion data on whether military/civilian master planners perceive BRAC policy implementation has impacted their community/installation (based on questionnaire results).

4) Compare empirical data (post-BRAC statistical findings) to the opinion data determining if perception (opinion) differs from reality (statistical). Empirical and opinion data are compared using a contingency table and chi-square test to determine association between empirical data and the associated opinion data for the installation/community. This test assumes interval data, with ordinal Likert scale items, in a recent review of the literature on this topic, Jaccard and Wan (1996, 4) summarize, "for many statistical tests, rather severe departures (from intervalness) do not seem to affect Type I and Type II errors dramatically."

5) Test the statistical data with a regression model to determine how the independent variables (rate of population density change/rate of population change) impact the dependent encroachment indicator variables.
6) Link conclusions from the comparison of the empirical and opinion data back to the research questions and corresponding hypotheses and provide a research summary.

3.3 Hypothesis

The null hypothesis is that there are no differences between reality and perception with respect to encroachment during the post-BRAC time period.

$$Ho: \mu 1 = \mu 2$$

Ho: Perceived Effects of Post-BRAC Encroachment 1 = Real Effects of Post-BRAC Encroachment 2

The alternative hypothesis is that there are differences between encroachment variables and the same perceived encroachment concerns between military installations and contiguous communities during the post-BRAC time period.

$$Ho: \mu 1 \neq \mu 2$$

Ho: Perceived Effects of Post-BRAC Encroachment 1 ≠ Real Effects of Post-BRAC Encroachment 2

3.4 Component One – Statistical Model

Eighty installations and their contiguous civilian communities (refer to Appendix A for complete list), all impacted by BRAC policies and programs, are examined against encroachment level data (pre-BRAC and post-BRAC). There are two possible statistical findings during analysis:

1. There is no significant difference in encroachment indicators between pre-BRAC and post-BRAC time periods.
2. There is a significant difference in encroachment indicators.

3.4.1 Encroachment Indicator Variables

The variables are encroachment indicator factors that influence or explain encroachment and are derived from the literature review. Each of the variables are examined for their measurement potential and applicability.

Encroachment indicator variables include:

- Regional Population and Regional Population Density - Level of population growth by community area is an indicator of urban growth and potential encroachment issues.
    - Measurement - Regional population and community land area data to portray urban growth around an installation. Regional population density is population divided by land area of the community (both in population density per acre and population density per square mile).
    - Equation: Regional Population Density = total population / community land area.
    - Source - US Census Bureau
- Light (lumens) Level - Light levels are a quality of life issue for surrounding communities. Light levels jeopardizes training missions by inability to perform

training missions, modified training techniques (simulation), and cancellation of training because of light levels from retail establishments within the surrounding community.

- Measurement- Areas of an installation located near commercial areas are considered to be prone to light pollution. Therefore, based on available data, a model is developed according to retail development standards to estimate community light levels (lumens). For this study, the number of retail establishments for each community is multiplied by the average pre-BRAC and post-BRAC size of retail establishments. The average pre-BRAC retail size is 35,000 square feet and the post-BRAC retail size is 60,000 (National Retail Federation). The average size of retail establishment also has an associated standard size of parking lot (based on Architectural Timesaver Standards of five (5) parking spaces per 1000 square feet). The pre-BRAC standard parking lot size is 61,250 square feet and the post-BRAC standard parking lot size is 105,000 square feet. The number of retail establishments for each community is multiplied by the standard parking lot square footage to determine a estimate of total parking lot area for each community. Each total parking area is then multiplied by the lux per square foot standard lighting.
- Equation: The light level (lumens) variable is the required parking square footage (based on retail square footage) multiplied by standard

lighting requirements per square foot (10 lux, or 0.929034 lumens per square foot) (Harris & Dines, 1988).

  - Source - US Census Bureau, Timesaver Standards for Parking Requirements and Lighting.

- Noise Level - Noise pollution jeopardizes training missions by loss of training time, modified training techniques (simulation), and cancellation of training because of complaints from the surrounding community. In this study, noise is categorized within three broad categories: basic training – 80 dB, live fire training – 130 dB, vehicular (tank) maneuver training – 100 dB, aircraft maneuver training – 140 dB, and missile training – 160 dB (Acoustical Society of America). Each of the five noise categories are near or above the normal threshold of pain (85 dB) which indicates that the noise is a nuisance.

Table 3.1 Noise Decibel Levels

Noise Levels (dB)	Effect
140	Extreme pain
130	Threshold of pain
120	Threshold of sensation
110	Regular exposure of more than 1 min. risks permanent hearing loss
100	No more than 15 min. unprotected exposure recommended.
90	Very annoying
85	Level at which hearing damage begins (8 hours)
80	Annoying
70	Intrusive
60	Comfortable
50	Comfortable
30	Very quiet
10	Just audible
0	Threshold of normal hearing (1000-4000 Hertz)

Source: La Societe Canadienne de L'ouie, 2007

- Measurement- Areas of an installation located within three miles of populated areas are considered to be noise sensitive. Therefore, based on Sustainable Installation Regional Risk Assessment (SIRRA) GIS data, noise sensitive installation areas in or within three (3) miles of a community is multiplied by the population per square mile of the community (based on census data). The maximum sound contour distance used by the Army to determine areas of highest noise impact is three (3) miles. The final variable is the population impacted by high noise levels.
- Equation – Noise Sensitive Area X Population Per Square Mile = Population Impacted by Noise.
- Source – DoD documents, SIRRA, USGS, US Census Bureau

- Residential Building Permits – Residential building permit data captures urban growth in communities contiguous to a military installation. BRAC legislation impacts the economic vitality (job availability) and population (troop and civilian contractor numbers) of a community. Therefore, a change in the number of residential building permits would indicate an encroachment impact from BRAC.
    - Measurement - Data depicts the amount of new housing construction within a community and be a measure of both population and economic vitality. Data is collected from the US Economic Census for each decade (1970, 1980, 1990, and 2000) for each of the eighty (80)

communities in the study. Any missing data is estimated based on the average growth rate for the respective decade (US Census Bureau, 2000). The following table presents the growth rates used to interpolate missing data.

Table 3.2 National Growth Rate

National Growth Rate	
1960-70	1.27%
1970-80	1.05%
1980-90	0.93%
1990-2000	1.01%

  - Equation – Building Permits Per Year
  - Source - US Census Bureau, Community Data

- Transportation Corridor Congestion - Transportation corridor variables are important because they capture the use and potential congestion of the road networks surrounding an installation. Corridor congestion indicates a potential encroachment issue.
  - Measurement - Transportation corridor impacts are captured through commute times and roadway traffic volumes of the contiguous community. Aggregate travel time to work is divided by populations for each community during 1980, 1990, and 2000. Data for aggregate travel time to work is unavailable for the 1970 time period. Data from 1980 represents pre-BRAC conditions and data from 1990 and 2000 represents post-BRAC conditions.

- Equation - Aggregate Travel Time to Work / Population = Commute Minutes Traveled Per Person
- Source - US Census Bureau, DoD documents

Table 3.3 Encroachment Indicator Variables

Encroachment Indicator Variables
Rate of Regional Population Change
Rate of Regional Population Density Change Population/Community Land Area
Light Levels Required parking square footage (based on retail square footage) multiplied by standard lighting requirements per square foot (10 lux, or 0.929034 lumens per square foot)
Noise Levels · Noise Sensitive Area X Population Per Square Mile = Population Impacted by Noise · Empirical Difference Between Pre-BRAC and Post-BRAC Training Decibels
Building Permits Building Permits Per Year
Transportation Corridor Impacts Aggregate Travel Time to Work / Population = Travel Time Per Person

3.4.2 Statistical Test

The nonparametric test, paired sample T test, determines the means between pre-BRAC and post-BRAC encroachment indicator data. This test determines if there are before-after differences encroachment indicator variables as a result of BRAC policy implementation. The level of significance for the paired T-test is set at .05, which is a 95% confidence interval. If the significance value is less than the level of significance (.05), then it is assumed that there is a significant difference with the indicator variables between pre-BRAC and post-BRAC. If the significance value is greater than .05, it is determined that there is no significant difference between the pre-

BRAC and post-BRAC time periods. A contingency table (cross tabulation) is used to compare the conclusions of the opinion questionnaire to the empirical statistical tests to determine whether or not to reject or fail to reject the null hypothesis.

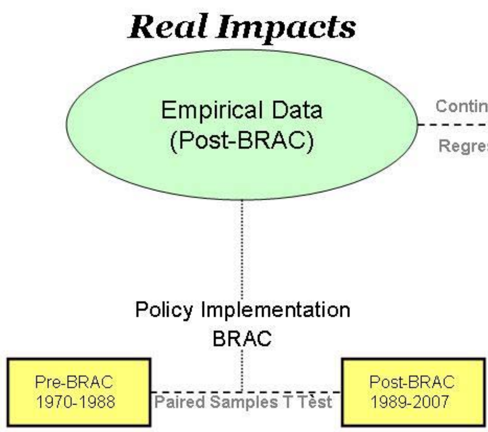

Figure 3.1 Research Approach and Methods

This research adds a regression analysis to determine the association between dependent encroachment indicator variables and the independent variable(s). The independent variable(s) used in this study are separately applied as trials: the rate of population density change and the rate of population change. Population reports and land area data are applied for each community and installation for each decade. Population is the most commonly-used growth indicator nationwide and is an indicator of urban growth and potential encroachment issues. Rising populations indicate an increase potential for encroachment on military installations. Higher population density indicates a higher demand for buildable land area, transportation network use, and use of natural resources (e.g. water) (Downs 1999), Higher population density levels also indicate that the health and safety of more people affected by military encroachment prone activities (e.g. training and testing). Therefore, in this study, rate of population change and rate of population density change is a persuasive and valid indicator to represent how BRAC policies are impacting communities and installations.

The regression model(s) are applied to uncover if either the rate of population density change or the rate of population change relates to each of the encroachment indicator variables: 1) light levels, 2) growth (building) rate, 3) noise levels, 4) transportation impacts. The regression model supports research findings from the Paired Samples T-Test, and is not the most significant component of this research.

3.5 Component Two – Self Report Questionnaire

The second component is a survey questionnaire completed by selected samples of both military master planners and civilian master planners who work at military bases or their communities. The wording of the questions measures opinions of master planners toward their perceived level of encroachment, types of encroachment, existing collaborative planning policies, and current planning tools. The questions capture the numbers of times and types of contact between military and civilian master planners. This questionnaire uncovers available encroachment mitigating tools, and their frequency of use in the post-BRAC period. The questionnaire survey covers these items:

- Basic employment information (location, years in service, employment with military or community).

- Personal experience with encroachment issues (e.g. Type(s) of encroachment issues the community/installation faces? (Such as light, noise, building distance, improper drainage, security problems, civilian bandwidth frequency demands, airspace, water supply, transportation infrastructure, competition for buildable land, health and safety problems, habitat and species protection)).
- Rating of most common complaints (e.g. air quality, noise complaints, training complaints).
- Perceived level of communication and coordination between military and civilian counterparts.
- Types of interaction between planners (number of phone calls per month, number of meetings per month, number or size of planning committees or boards).
- Descriptive aspects about the frequency of engagement of collaborative planning efforts (e.g. open discussion/information sharing, involvement in planning boards, stakeholder meetings, focus groups, other).
- Assessment of planning tools used (e.g. special zoning provisions, subdivision regulations, targeted, or special funds, local-federal partnerships, citizen participation meetings). special zoning provisions
- Reported belief in quality of relationships(strong to weak)
- Frequency of use of collaborative planning tools (e.g. JLUS, PONDS, ICUZ, ACUB, other).

The same survey instrument was administered to each group (both military and civilian). Approximately one-hundred sixty (160) surveys were emailed to military and civilian planners (80 surveys each group). The participants in this research are considered experts on the subject of military and civilian joint land use planning, and involved with either military or community master planning. The survey questionnaire consists of closed-ended questions about planning methodologies and their perceived relationship with the military or civilian counterparts. A section of the instrument is available for further open-ended response from the planners. This section serves as the interview section and allows the participants to voice their opinions and impressions of the relationship between military and civilian planning, as well as their opinions of the planning tools that are available or unavailable for use.

3.6 Data Sources

Statistical data sources include DoD records, census data, planning regulations (military and civilian), research studies, and Army Knowledge Online (AKO). Additional background data is developed from a variety of sources including: planning documents, research studies, planning regulations (both military and civilian). Survey results from the military and civilian planners are another source of data. Data from the survey questions describes the types of encroachment (e.g. noise, air, water) that planners encounter and the amount of interaction and communication between military master planners and their civilian counterparts during the post-BRAC era.

3.7 Sampling

Eight of the nine military districts of the United States Army are included in this study. The Gulf Region District in not included in this research because it does not face the same issues as BRAC Legislation for the stateside installations and their communities. Survey questionnaires were sent to a 100 percent sample of the remaining 80 military installations of the eight military districts. [Refer to Appendix A for a complete list of installations and communities.] In total, one-hundred and sixty (160) survey questionnaires were sent and returned by email using a web-based questionnaire company (Perennial Survey).

3.8 Sample Description

Most of the 80 Army installations have changed by mission realignment and/or additional military operations. For the purpose of this research, the term 'community' is used when referring to the city or other political jurisdiction surrounding a military installation. Even though the communities can differ in size, location, and social composition, military communities share common social and economic characteristics that make them comparable. Some of these similar characteristics are:

- Installations provide many direct and indirect (e.g. contract) jobs, which makes it labor-intensive.
- The installation is non-profit and is eligible for huge tax exemptions. In other words the military installation is "a nonprofit firm whose activities have been paid for almost entirely by tax dollars" (Lutz 2001, 183).

- Soldiers who live on an installation pay no property tax to communities but still use community resources such as parks, schools, emergency services, roads, and other public infrastructure. This becomes an economic burden for the off-base community.
- The military has an egalitarian pay scale that provides for a relatively high average income. This income is approximately 12% higher than the household national average (Lutz 2001).
- The military installation has an authoritarian structure that "makes claims on all aspects of a member's life" (Lutz 2001, 197). There are many controls (e.g. when military individuals are allowed to leave post, when they eat, when and how they exercise, what they wear) that regulate the lifestyle of those associate with the military installation, which in turn affects the social structure of the community as well.
- A military community must deal with huge turnover rates from deployment and changes in missions. Military individuals and their families are never in one place for long, meaning that the community population constantly changes.
- The military is male dominated (women only make up approximately 14% of the military) because of the "continuing belief that war is a male job because men are stronger and more aggressive and women are life givers rather than takes" (Lutz 2001, 191). This has an economic impact

because men typically earn more than women, which indicates a higher than normal household income.

- A military community may get support aid from the federal government for economic burdens from the installation. Many communities with military installations that are poised for closure or realignment due to BRAC legislation receive government assistance in order to defer some of the economic impact of the change.

CHAPTER 4

RESEARCH FINDINGS

4.1 Research Expectations and Assumptions

With respect to the study hypothesis, the expected research finding is that there is no difference between real impacts and opinions from policy implementation. This indicates that professional planning opinions are accurate. Findings in the literature review of the relationship between public opinion and public policy implementation are supported. Additionally, from the opinion data, there are insufficient coordination and communication between military and civilian master planners. This lack of collaboration indicates a possible connection between increases in urban encroachment between military installations and their surrounding communities. Additionally, this research encourages interest in the level of collaborative interaction among policy makers and planners involved in military/community partnerships.

Finally, the research concludes with findings about inter-governmental communications and land use problems (e.g. between economic partners, university-community, industry-community, and military-community). Based on the opinion questionnaires, the study reveals encroachment alternatives and options to help address these land use challenges during DoD Transformation and BRAC 2005 initiatives.[1]

[1] The U.S. Army and its Corps of Engineers supports the completion of the study and possibly employ the findings when reforming Army Regulations (AR).

4.2 Results

The statistical analysis of pre-BRAC and post-BRAC data examines change between means in encroachment indicator variables from pre-BRAC to post-BRAC. The paired samples t-test computes differences between the means of encroachment indicator variables for each case, and tests to see if average differences are significantly different. The test assumes that the deviations are normally distributed. However, the paired-sample t-test does not assume that pre-BRAC and post-BRAC data variances are equal or have normal distributions. The previously stated hypotheses are the foundation for the paired-samples t-test.

The following opposite hypotheses are the foundation for the paired-samples t-test.

Null: There is no significant difference between the means of the two variables.

Alternate: There is a significant difference between the means of the two variables.

Table 4.1: Paired Samples Statistics lists mean encroachment indicator variable levels before (1970-1988) and after (1989-2007) BRAC policy implementation (1988). Table 4.1 indicates that there is an overall increase with amount of light lumen levels, residential building permits, travel time to work per person, and decibel level. There has been a decrease in regional population density and number of persons impacted by high noise levels.

Table 4.1 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-BRAC Estimate Amount of Light (lumens)	67384739.77	61	106698974.72	13661403.81
	Post-BRAC Estimate Amount of Light (lumens)	82222250.41	61	115686207.66	14812101.08
Pair 2	Pre-BRAC Residential Building Permit	1457.08	69	3517.04	423.40
	Post-BRAC Residential Building Permit	1500.12	69	5564.22	669.85
Pair 3	Pre-BRAC Average Travel Time To Work Per Person	7.72	74	4.22	.49
	Post-BRAC Average Travel Time To Work Per Person	9.22	74	5.80	.67
Pair 4	Pre-BRAC Regional Pop Density - Pop/Land Area (Square Mile)	3410.95	80	5602.06	626.33
	Post-BRAC Regional Pop Density - Pop/Land Area (Square Mile)	2852.18	80	5138.89	574.54
Pair 5	Pre-BRAC Estimate of Number of Persons Impacted by Noise	887220.61	75	1691415.08	195307.79
	Post-BRAC Estimate of Number of Persons Impacted by Noise	699095.98	75	1216568.28	140477.20
Pair 6	Pre-BRAC Decibel Levels	99.00	80	25.03	2.79
	Post-BRAC Decibel Levels	105.00	80	24.39	2.72

4.2.1 Encroachment Indicator Variables

Table 4.2: Paired Samples Correlations lists correlations for the six (6) encroachment indicator variables. All variables show strong positive correlation between the two time periods.

Table 4.2 Paired Samples Correlations

		N	Correlation	Significance
Pair 1	Pre-BRAC and Post-BRAC Estimate Amount of Light (lumens)	61	.975	.000
Pair 2	Pre-BRAC and Post-BRAC Residential Building Permit	69	.960	.000
Pair 3	Pre-BRAC and Post-BRAC Average Travel Time To Work Per Person	74	.461	.000
Pair 4	Pre-BRAC and Post-BRAC Regional Pop Density (Square Mile)	80	.785	.000
Pair 5	Pre-BRAC and Post-BRAC Estimation of Number of Persons Impacted by Noise	75	.891	.000
Pair 6	Pre-BRAC and Post-BRAC Decibel Level	80	.900	.000

For this research, when the significance value is less than P = 0.05, at a 95% confidence interval, there is a significant difference between means. This indicates that the change that occurred between pre-BRAC and post-BRAC is greater than would be expected by chance which indicates that there is a statistically significant change (P = 0.000). Four (4) of 6 encroachment indicator variables are significantly different for the pre-BRAC and post-BRAC time periods (Table 4.3: Paired Samples Test Results). Therefore the null hypothesis that there is no significant difference between the means of the two variables is rejected for 1) estimate of light (lumens), 2) aggregate travel time to work, 3) estimate of number of persons impacted by noise, and 4) decibel levels. Of these four variables, all showed an increase except the estimate number of persons impacted by high noise levels.

Table 4.3 Paired Samples Test Results

		Paired Differences							
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**		**t**	**df**	**Sig. (2-tailed)**
					Lower	Upper			
Pair 1	Pre-BRAC and Post-BRAC Estimate Amount of Light (lumens)	-14837510.63	26397032.21	3379793.64	-21598104.49	-8076916.76	-4.390	60	.000
Pair 2	Pre-BRAC and Post-BRAC Residential Building Permit	-43.03	2399.43	288.85	-619.44	533.37	-.149	68	.882
Pair 3	Pre-BRAC and Post-BRAC Average Travel Time To Work Per Person	-1.49	5.37	.62	-2.74	-.25	-2.394	73	.019
Pair 4	Pre-BRAC and Post-BRAC Regional Pop Density (Square Mile)	558.76	3545.78	396.43	-230.30	1347.84	1.410	79	.163
Pair 5	Pre-BRAC and Post-BRAC Estimation of Number of Persons Impacted by Noise	188124.63	820245.63	94713.80	-596.75	376846.01	1.986	74	.051
Pair 6	Pre-BRAC and Post-BRAC Decibel Level	-6.00	11.09	1.24	-8.46	-3.53	-4.838	79	.000

From the outcome of this statistical analysis, due to lower post-BRAC regional population density, fewer people are impacted by training and testing noise. The analysis failed to reject the null hypothesis for the two encroachment indicator variables, regional population density and residential building permits. This finding indicates that there was little, if any change, occurring between pre-BRAC and post-BRAC time periods. Table 4.4: Paired Samples Summary summarizes these findings.

4.2.1.1 Light

For light levels, the T value is -4.390 with a sample size of 61 (60 degrees of freedom). There is an increase in light levels between pre-BRAC and post-BRAC time periods. The significance of this variable is 0.000 at the 0.05 level; therefore the null hypothesis is rejected that there is no significant difference between the means of the variables.

4.2.1.2 Residential Building Permits

For residential building permits, representing the growth rate of communities, the T value is -0.149 with a sample size of 69 (68 degrees of freedom). There is an increase in residential building permits from pre-BRAC to post-BRAC time periods (Table 4.1: Paired Samples Statistics). However, the significance of this variable is 0.882 at the 0.05 level; therefore the research fails to reject the null hypothesis that there is no significant difference between the means of the variables.

4.2.1.3 Transportation Corridor Congestion

For average travel time to work per person, the T value is -2.394 with a sample size of 74 (73 degrees of freedom). There is an overall increase in travel time to work (per person) from pre-BRAC to post-BRAC time periods (Table 4.1: Paired Samples Statistics). However, the significance of this variable is 0.019 at the 0.05 level; therefore the research rejects the null hypothesis that there is no significant difference between the means of the variables.

4.2.1.4 Population Density

For regional population density, the T value is 1.410 with a sample size of 80 (79 degrees of freedom). There is a decrease in regional population density (population per square mile) from pre-BRAC to post-BRAC time periods (Table 4.1: Paired Samples Statistics). However, the significance of this variable is 0.163 at the 0.05 level; therefore the research fails to reject the null hypothesis that there is no significant difference between the means of the variables.

4.2.1.5 Noise

The T value is 1.986 for number of persons impacted by high noise levels. For this encroachment indicator variable there is a sample size of 75 (74 degrees of freedom). This variable has a significant reduction in persons affected by noise from pre-BRAC to post-BRAC. The variable capturing the estimate number of persons impacted by noise changed at the .05 significance level. However, there is an increase in means between pre-BRAC and post-BRAC decibel levels (Table 4.1: Paired Samples Statistics). Decibel levels have a sample size of 80 (79 degrees of freedom). This variable has a T value of -4.838 and is significant at the .05 level (P=.00). Both noise variables significantly changed from pre-BRAC to post-BRAC time periods, although one experienced an increase and the other a decrease (Table 4.1: Paired Samples Statistics). Therefore the null hypothesis is rejected that there is no significant difference between the means of the variables.

Table 4.4 Paired Samples Summary

		Overall Change	Reject Null Hypothesis
Pair 1	Pre-BRAC and Post-BRAC Estimate Amount of Light (lumens)	Increase	Yes
Pair 2	Pre-BRAC and Post-BRAC Residential Building Permit	Increase	No
Pair 3	Pre-BRAC and Post-BRAC Average Travel Time To Work Per Person	Increase	Yes
Pair 4	Pre-BRAC and Post-BRAC Regional Pop Density (Square Mile)	Decrease	No
Pair 5	Pre-BRAC and Post-BRAC Estimation of Number of Persons Impacted by Noise	Decrease	Yes
Pair 6	Pre-BRAC and Post-BRAC Decibel Level	Increase	Yes

4.3 Opinion Research Results

4.3.1 Basic Employment Data Results

Of the 160 military and civilian planners, the response rate is 88% (141 responded). Of the total 141 respondents, 74 are military master planners, 61 are associated with civilian master planning, and 6 are contracted project integrators working with the military on BRAC related projects. Figure 4.1: Employment Association shows the percentage of respondents associated with the military and the community. Figure 4.2: Employment Position depicts the job titles of the respondents. The survey results also show that the respondents have a varied amount of professional experience (Figure 4.3: Years of

Employment). Forty-six percent (46%) have more than twenty-one years experience in their position and thirty-three percent (33%) have worked in their position for less than five years. The remaining twenty percent (20%) of the respondents have worked in their position between six and ten years.

Figure 4.1 Employment Association

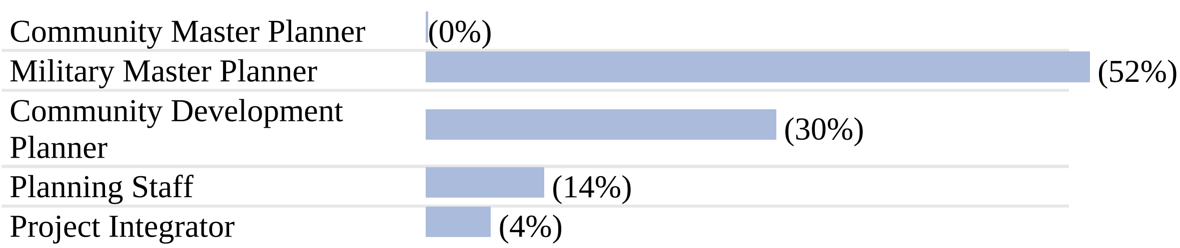

Figure 4.2 Employment Position

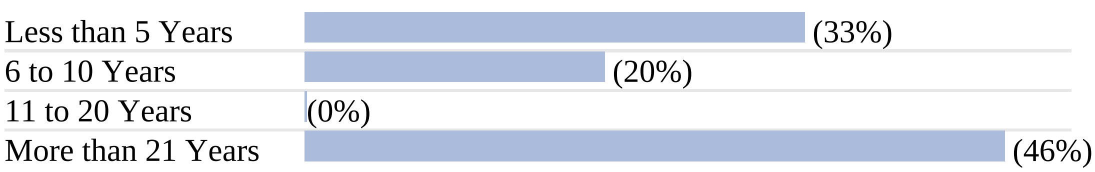

Figure 4.3 Years of Employment

4.3.2 Experience with Encroachment

The respondents were asked their level of planning involvement in respect to encroachment issues. Seventy percent (70%) of the civilian and military respondents are involved or somewhat involved in planning techniques in order to mitigate encroachment. Thirty percent (30%) are not involved with encroachment mitigation. All project integrators surveyed (4%) are not involved in any encroachment mitigation planning. Figure 4.4: Common Encroachment Complaints depicts common encroachment complaints faced by planners. Noise (20%), encroaching growth (17%), airspace sharing (14%) are the most frequent encroachment issues. Air quality, security issues, and habitat and species protection (all 10%) are also common encroachment concerns. Of the respondents, forty-three percent (43%) believe that there has been an increase in numbers of encroachment complaints post-BRAC. Overall, seventy-four percent (74%) believe that encroachment is an issue for their community and installation. Figure 4.5: Encroachment Impacts Facing Community/Installation depicts base or community conflicts, static, or connection problems impacting an installation or community.

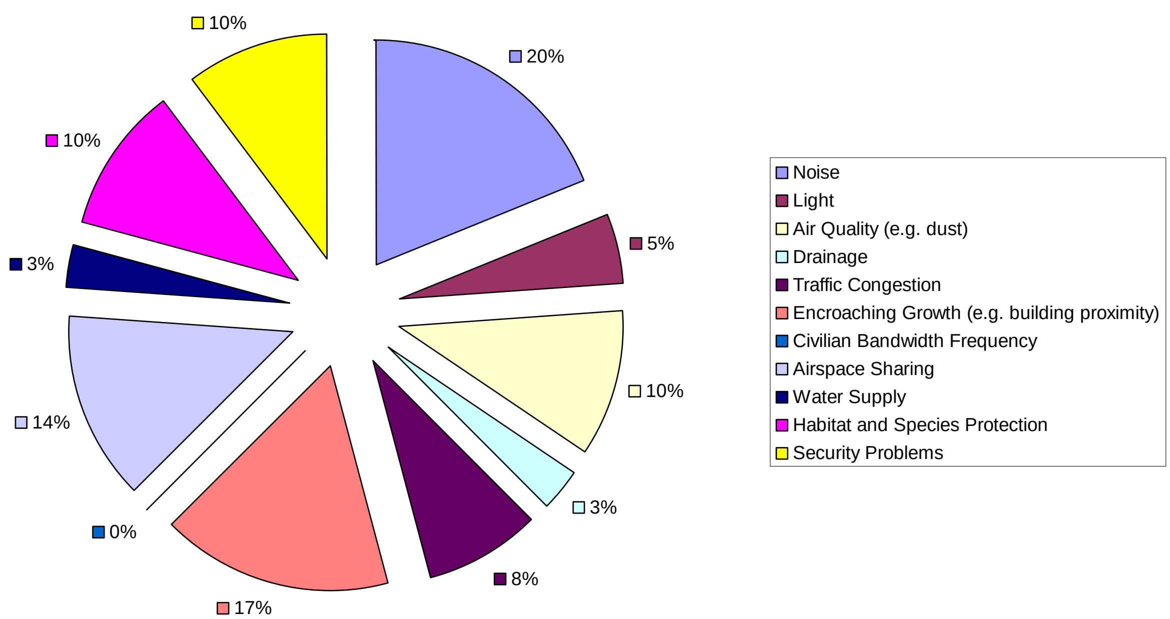

Figure 4.4 Common Encroachment Complaints

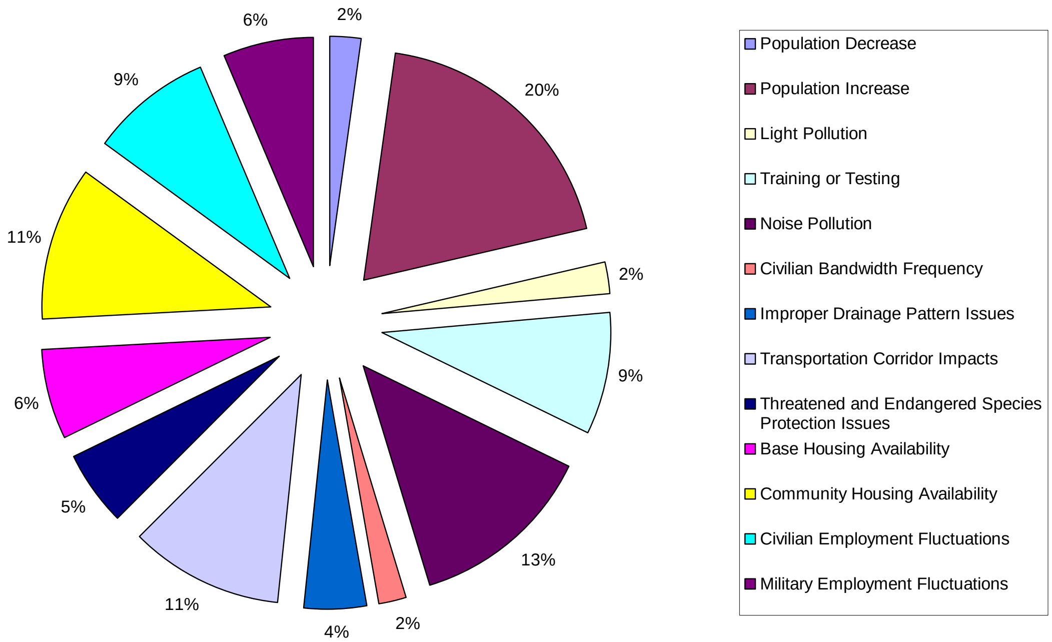

Figure 4.5 Encroachment Impacts Facing Community/Installation

There are several questions that are directly associated with the encroachment indicator variables. A large number (75%) of survey participants believe that high noise levels (e.g. testing noise, training noise) is an issue for their community or installation (Figure 4.6: Noise). Conversely, thirty-one percent (31%) of planners believe that high light levels (e.g. retail light) is an issue for their community or installation. Sixty-nine percent (69%) do not believe light is an encroachment issue (Figure 4.7: Light).

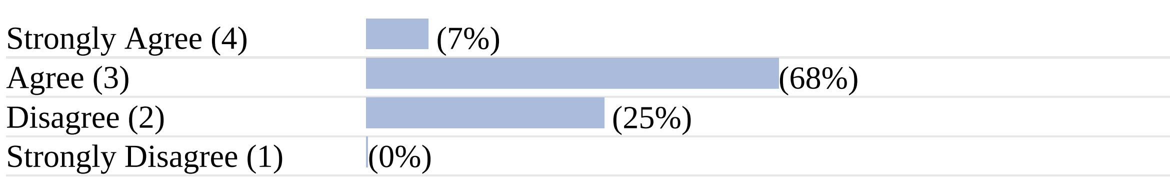

Figure 4.6 Noise

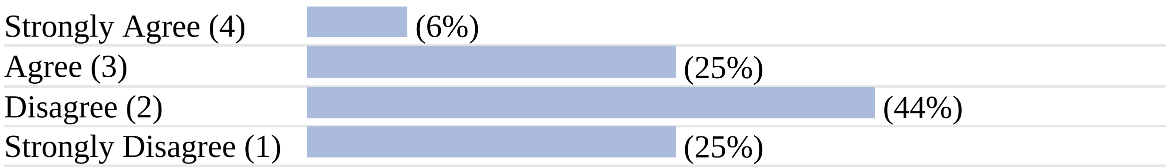

Figure 4.7 Light

Twenty-eight percent (28%) believe their community or installation experienced a population decrease after BRAC implementation. Seventy-six percent (76%) of the planners surveyed believe that their community or installation experienced high levels of population growth after BRAC implementation. A majority of planners (70%) also believe that their community or installation faces land encroachment problems (e.g. close proximity building or facility development) from community or military buildings or facilities. Planners were questioned about post-BRAC transportation (e.g. traffic congestion) impacts on their community or installation. Seventy-four percent (74%) think transportation problems increased post-BRAC; whereas, only twenty-six percent (26%) think that transportation problems have not changed (Figure 4.8: Transportation Impacts post-BRAC).

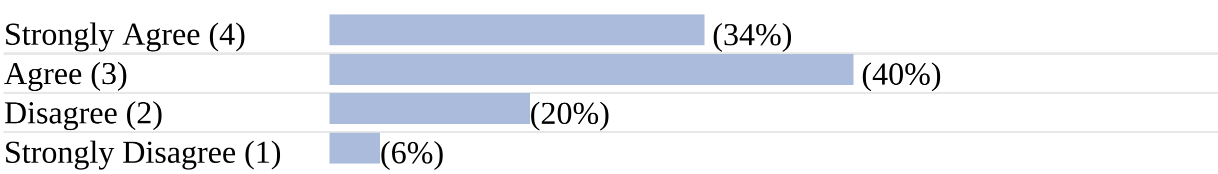

Figure 4.8 Transportation Impacts post-BRAC

Table 4.5: Opinion Descriptive Data shows the mean and standard deviation of the five encroachment variables based on the survey results. The questions asked about post-

BRAC opinions on a Likert scale with answers ranging from strongly disagree (1) to strongly agree (4). The mean for noise level impact opinion is 2.8194. The mean for light level opinion is 2.1588. The mean for transportation impact opinions is 3.1094. The mean for building level increase opinions is 3.0458. Finally, the mean for population increase post-BRAC opinions is 3.1458. All opinion based variables are highly correlated, meaning that correlation is significantly different from zero and are significant based on the two-tailed p-value. Inter-variable correlations are found in Appendix E, Statistical Results.

Table 4.5 Opinion Descriptive Data

		Noise Impacts	Light	Transportation (Travel Time)	Residential Bldg.Level Increase post-BRAC	Population Increase post-BRAC
N	Valid	80	80	80	80	80
	Missing	0	0	0	0	0
Mean		2.8194	2.1588	3.1094	3.0458	3.1458
Std. Error of Mean		.05664	.09485	.10266	.11317	.09923
Median		3.0000	2.0000	3.0000	3.0000	3.0000
Mode		3.00	2.00	4.00	4.00	4.00
Std. Deviation		.50657	.84833	.91821	1.01226	.88758
Variance		.257	.720	.843	1.025	.788
Minimum		2.00	1.00	1.00	1.00	1.00
Maximum		4.00	4.00	4.00	4.00	4.00

4.3.3 Collaborative Planning and Communication Levels

The results for intergovernmental communication show a low level of interaction between military and civilian master planners. Each month, fifty percent (50%) of planners participate in written communication (e.g. emails, memos) one to five times. Sixty-two (62%) percent of planners have verbal or oral intergovernmental communication between one and five times each month. Seventy-four percent (74%) believe that the current planning policies of their agency affect the amount of communication and coordination between military installations and communities. A majority of the military master planners (or equivalent profession) felt that their military planning approaches affect the amount of inter-governmental collaboration. As discussed previously, the theoretical foundations differ between military and civilian planning approaches. The military practices rational planning driven by political decisions, funding, and current missions, whereas the community (civilian) master planners typically practice ad hoc planning. The military master planner is concerned with successful mission (operational and institutional) completion. Therefore, land use planning is viewed by the military master planner as being an institutional mission that must be carried out in support of an operational mission. This approach to land use planning ensures military planning is efficient and functional. Since the implementation of BRAC and DoD Transformation, community planners are attempting to shift away from traditional rational planning approaches. Military installations and surrounding communities are beginning to understand the importance of collaborative planning initiatives, especially in preparing for the social, economic impacts of BRAC implementation. Due to close proximity, what impacts one also impacts the other.

However, even though community master planners feel it is more important to collaborate, eighty-seven percent (87%) of the total respondents feel that the current amount of interaction between their agency and their military or civilian counterparts is appropriate for this level of collaboration. Also, although military master planners feel limited by existing policies in their interaction with civilian master planners, ninety-three percent (93%) of all respondents believe they are adequately and properly informed of any major land use plan or decision by their community or installation. Seventy-four percent (74%) thought it likely that their community or installation will become involved in a joint land use planning study as a result of post-BRAC conditions.

The type of collaborative planning for military and civilian master planners is depicted in Figure 4.9: Types of Collaboration between Planners. Personal contact, meetings, and information sharing are the most frequent types of collaborative planning methods used. Conference phone calls and public stakeholder meetings are the most infrequent types of collaboration. Even though personal contact, meetings, and in-person information sharing are the most frequent types of collaboration, participation is still limited to one to five times a month.

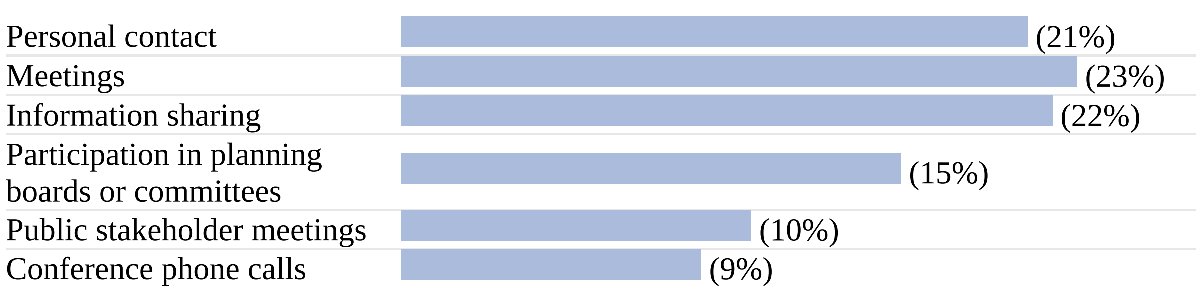

Figure 4.9 Types of Collaboration between Planners

Figure 4.10: Frequency of Use of Encroachment Minimizing Tools indicates the types of planning tools used by military and civilian master planners. The most frequent tools used to eliminate encroachment include: JLUS – Joint Land Use Planning, local planning/zoning board participation, planning update briefings, and technological tools. PONDS, Urban Growth Boundaries, and special district ordinances are seldom used for encroachment mitigation (Figure 4.10: Frequency of Use of Encroachment Minimizing Tools).

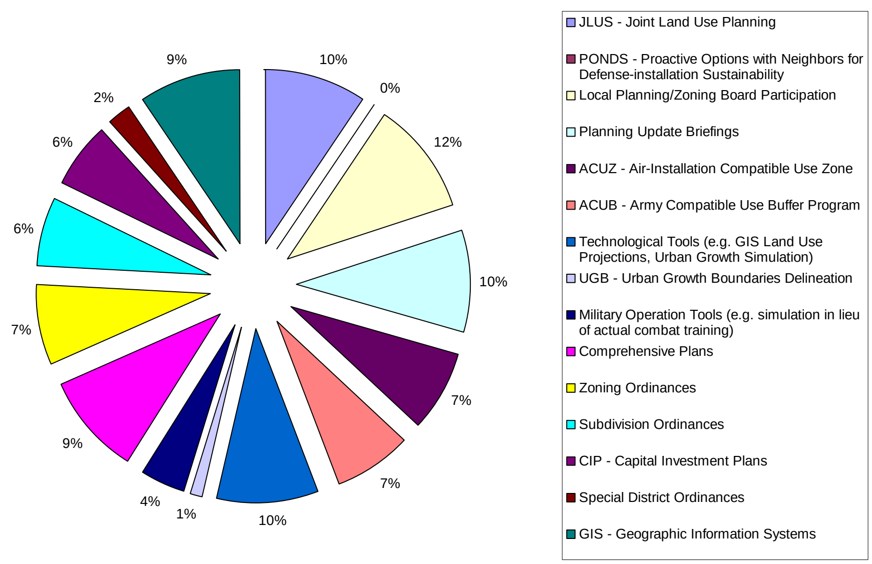

Figure 4.10 Frequency of Use of Encroachment Minimizing Tools

4.4 Contingency Table Results

After completion of the paired samples t-test and the opinion survey, a contingency table was developed to determine the association between the outcomes of the empirical and opinion variables. Each survey response is linked to the corresponding community/installation. The contingency table hypotheses are as follows:

Null: There is no association between the opinion and post BRAC empirical data (two variables).

Alternate: There is an association between the two variables

The contingency tables (Chi-square) analysis shows that only one of the five encroachment indicator variables is significant at the .05 level. Therefore, this analysis rejects the null hypotheses for light, transportation, residential building permits, and population density. There is no association between the opinion survey results and the aggregate data outcomes for these variables.

The only data set that depicts an association between the two variables is noise, which is significant at the .05 level (refer to Table 4.6: Noise Chi-Square Test). Therefore, for the noise variable this research must reject the null. The findings are significant at the .05 level; there is an association between the two variables.

Table 4.6 Noise Chi Squared Test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.906[a]	24	.000
Likelihood Ratio	41.731	24	.014
Linear-by-Linear Association	9.828	1	.002
N of Valid Cases	75		

a. 31 cells (88.6%) have expected count less than 5. The minimum expected count is .01.

The outcome of the contingency table and the Chi-square test indicates that the civilian and military master planners opinion measurements only match reality (statistical measurement) in only one out of five variables. This indicates that professional (military/civilian) opinions do not match the statistical reality of the installation/community for four out of five of the encroachment variables. On a site-by-site evaluation using a contingency table, professional opinion does not match statistical reality.

4.5 Regression Analysis

After cross tabulation, two regression analyses were run to examine how one variable (both the rate of population change, rate of population density change) may be related to other variables (the dependent, encroachment indicator variables). Two types of regression procedures are studied in this research, 1) rate of population change as the independent variable, and 2) rate of population density change as the independent variable, both using constant land areas and changes in land areas. Population is a measure of how many people live within a community. Population density gives more detail of how many people live within a specified area (square mile or square acre). Population density gives an indication of how crowded an area is. Population density is also an indicator of quality of life for a community. This study approached population density calculations in two ways: 1) population based on changed land areas, 2) population based on constant land areas. Refer to Appendix F for statistical findings based on a constant land area. The dependent variables of this study are the remaining encroachment indicator variables.

There is a high correlation between the dependent and independent variables. However, all variable scores are below .75 in the correlation table (Appendix E). However, strong correlation does not necessarily indicate that changing one variable impacts the other variable.

The two regression analyses result in low correlations (R Squares), and even lower adjusted R Squares (Table 4.7 and 4.8) An R-squared value close to one (1) indicates a strong relationship between the two variables; in this research the relationships are low and even negative. This finding indicates little or no relationships when taking into account all variables in the model; the model doesn't account for the variation of the dependent variables are from the independent variables (Backstrom 1981). This indicates that most of the variation is unexplained by the independent variable(s), and therefore be accounted for by missing variables, errors of measurement or by the non linear aspects of the relationship. Only the transportation (travel time to work) model is significant at a p =.05 level but no relationship can be noted. The other regression procedures (models) are not significant at a .05 level. Rate or population density change and rate of population change appear not to be a factor in predicting changes in encroachment indicator variables (refer to Appendix E for results of all regression models). There is no linear relationship between population change/population density change and the encroachment indicator variables. The variations in the encroachment indicator variables are not explained by population change/population density change; rather, variations may be explained by unknown (lurking) independent variables. Therefore this research fails to reject the null hypothesis that there is no difference between rate of population density change or rate of population change and the encroachment indicator variables.

Table 4.7 Regression with Rate of Population Density Change as Independent Variable

Encroachment Indicator Dependent Variables	***R 2***	***Adjusted R 2***	***ß***	***ANOVA Significance***	***Coefficient Significance***
Noise Level	0.003	-0.01	7.055	0.639	0.000
Light (Lumens)	0.008	-0.009	34.488	0.493	0.000
Transportation (Travel Time to Work)	0.019	0.006	25.663	0.237	0.007
Residential Bldg. Permits	0.033	0.018	-9.169	0.136	0.409

Table 4.8 Regression with Rate of Population Change as Independent Variable

Encroachment Indicator Dependent Variables	***R 2***	***Adjusted R 2***	***ß***	***ANOVA Significance***	***Coefficient Significance***
Noise Level	0.000	-0.013	6.997	0.968	0.000
Light (Lumens)	0.003	-0.014	32.6	0.668	0.000
Transportation (Travel Time to Work)	0.068	0.055	12.904	0.025	0.220
Residential Building Permits	0.008	-0.007	-14.070	0.459	0.279

CHAPTER 5

CONCLUSIONS

5.1 Opinion and Empirical Data Comparison

5.1.1 Light

Overall, professional perception does not match reality for light changes post-BRAC. The paired T-test result shows that the light levels pre- and post-BRAC have a significant difference (increase) at .000 (p=.05). However, sixty-nine percent (69%) of survey participants believe that light levels are not an issue for their community or installation post-BRAC. The chi-test outcome shows that there is no association between the empirical data and the opinion results.

5.1.2 Residential Building Permits/Development Growth

Overall, professional perception does not match reality for building development changes post-BRAC. The paired T-test shows that the residential building development levels pre- and post-BRAC does not have a significant difference at .882 (p=.05). However, seventy percent (70%) of survey participants believe that land encroachment problems (e.g. close proximity building or facility development) from community or military buildings or facilities is an issue for their community or installation post-BRAC. The chi-test outcome shows that there is no association between the empirical data and the opinion results.

5.1.3 Transportation Corridor Congestion

Overall, professional perception does not match reality for traffic corridor increases post-BRAC. The paired T-test shows that the transportation impacts pre- and post-BRAC do have a difference (increase) at .019 (p=.05). Seventy-four percent (74%) of survey participants believe that transportation corridor congestion is an issue for their community or installation post-BRAC. However, the chi-test outcome shows that there is no association between the empirical data and the opinion results.

5.1.4 Population Density

Overall, Professional perception does not match reality for population density changes post-BRAC. There is a decrease in regional population density (population per square mile using 1980 and 2000 community and installation boundaries) between pre-BRAC and post-BRAC time periods. However, the low correlation of these two variable at 0.163 (p=0.05) means the research fails to reject the null hypothesis that there is no significant difference between the means of the variables. However, seventy-six percent (76%) of the planners surveyed believe that their community or installation experienced high levels of population growth after BRAC implementation.

5.1.5 Noise

Overall, professional perception matches reality for noise decibel level changes post-BRAC. The paired T-test (Table 4.3: Paired Samples Test Results) shows that the decibel levels pre- and post-BRAC have a significant difference (increase) at .000 (p=.05). Also, a majority (75%) of survey participants believe that high noise levels (e.g. testing noise, training noise) is an issue for their community or installation post-BRAC.

The paired T-test (Table 4.3: Paired Samples Test Results) shows that the percentage of population impacted by noise pre- and post-BRAC did not have a significant difference at the .05 level. Percentage of population actually decreased post-BRAC. This indicates that population density, specifically the increase in community size pre-BRAC and post-BRAC, is a determining factor of potential number of people impacted by noise, as well as other encroachment issues.

5.2 Summary of Contingency Table

The outcome of the contingency table and the Chi-square test indicates that the civilian and military master planner's opinion measurements only match reality (statistical measurement) in only one out of the five encroachment variables. When all the data is taken in totality, professional opinion appears to match reality; however, on a site-by-site evaluation, professional opinion does not match reality.

The results for intergovernmental communication show a low level between military and civilian master planners. Each month, fifty percent (50%) of planners participate in written communication (e.g. emails, memos) one to five times. Sixty-two (62%) percent of planners have verbal or oral intergovernmental communication between one and five times each month. From this information it can be concluded that the outcome of professional opinion not matching statistical reality could be due to low levels of intergovernmental communication/collaboration among military and civilian planners. The difference in military and civilian planning theoretical foundations may add to the discrepancy between perceived opinions and real impacts. Seventy-four percent (74%) believe that the current planning policies of their agency affect the amount of communication and coordination between military installations and communities. Therefore, type of planning approach and frequency of collaboration could be the connection between incorrect professional opinions not matching in these statistical findings.

5.3 Summary of Regression Model

The regression model(s) depict that there is no linear relationship between population change/population density change and the encroachment indicator variables. The variations in the encroachment indicator variables are not explained by population change/population density change; rather, they are explained by unknown (lurking) independent variables. Therefore the research must fail to reject the null hypothesis that there is no difference between rate of population density change or rate of population change and the encroachment indicator variables. This research did not specifically seek to prove that BRAC policy impact encroachment indicator variables; but rather sought to determine if professional opinion matches statistical reality. The outcome of the regression model(s) provides an interesting lead into further research to determine how to adequately predict impacts caused by BRAC from other lurking variables (e.g. economic, housing, land use) in association with population and population density.

5.4 Conclusions/Discussions

After the above analysis of the paired sample t-test and the opinion survey, professional opinion can be concluded to not match reality for four of the five encroachment indicator variables. Therefore, this research rejects the null hypothesis, Ho: Perceived Effects of Post-BRAC Encroachment 1 = Real Effects of Post-BRAC Encroachment 2, for the following encroachment indicator variables:

- Light (lumens)
- Residential Building Permit/ Development Growth
- Population Density
- Percent Population Impacted by Noise
- Transportation Impacts

Professional perception matches reality for only one of the encroachment indicator variables. Therefore, this research fails to reject the null hypothesis for the following:

- Noise Decibel Level

From this research, professional opinions are not always in-line with reality. An important broad conclusion appears to be that population and population density are integral to the extent encroachment impacts are believed or first developed in the minds of professionals.

5.5 Research Limitations

This study compared post-BRAC empirical data with post-BRAC opinion data (gathered from survey questionnaires). Several post-BRAC conditions limit this study. First, there is no pre-BRAC opinion data developed to use in this study. Subjects (military and civilian master planners) may not be knowledgeable of past policies and conditions. The survey results show that thirty-three percent (33%) of the respondents have worked in their positions for less than five years. The respondents may not realize how DoD Transformation changed the post-BRAC culture of the military's business practices (e.g. streamlined processes).

Another limitation is the recent implementation of state and local encroachment mitigation legislations. In the past, collaboration was not encouraged between military installations and their surrounding communities. This recently changed in 2003 when Legislation was passed that allows military installations to enter into cooperative arrangements with states, local governments and other private organizations.

There are other method limitations considered within this study. One validity issue for generalizing these results to all military installations is the need to include other branches' military installations. The 80 Army samples studied in this research are assumed to be representative of other non-Army installations impacted by BRAC (e.g. Air Force, Navy, and Marine bases).

5.6 Future Research

Findings from this study are that there are differences between the real and perceived effects of public policy implementation. This research can be used as a basis for future research that applies to different types of policies (local, regional, state) or determines differences between real and perceived impacts from the implementation of other policies. This investigation investigates real and perceived impacts of a national policy. Further research could include evaluating real and perceived impacts of the implementation of other national policies (e.g. economic and social policies) or local or regional policies (e.g. economic, housing, land use, open space preservation).

This research only considered Army and Army National Guard bases or installations. The research does not capture differences for Air Force, Navy or Marine bases or installations. In this study, the research design was targeted but assumed that the findings would hold true across the other service branches. Branches of military service have different training requirements, space allocations, missions and operations that potentially impact their contiguous communities. Similar studies may be developed to determine if conclusions would be similar for other branches of the military.

This research only studied pre-BRAC and post-BRAC conditions for the following encroachment indicator variables: 1) noise, 2) light, 3) building rate, 4) population density, 5) transportation corridor congestion. There are several other encroachment indicator variables that could be evaluated using the same research model. Future encroachment indicator variables could include: 1) civilian bandwidth frequency interference, 2) improper drainage, 3) number of dwelling units, 4) number of employed, and 5) threatened and endangered species protection issues.

The outcome of this research could also be used as groundwork to establish whether or not adjustments or additional policies are implemented to counteract expected impacts of the initial policy. Further research is needed to determine how real and perceived policy implementation impacts influence future policy development and implementation. Based on the findings from this study, professional opinions that become the basis for planning policies are not always in-line with reality. Therefore it would be important to further study how this mismatch affects subsequent policy creation.

Even though this research attempted to capture supporting data from surveys to determine levels of coordination and cooperation between military installations and communities, further research could determine how level of collaboration and communication impact policy perception and professional opinion. Historically, the military influences civilian policy-making. Since World War II, military persons have occupied a large number of federal and state offices (Sprout 1948). The new military approach of joint readiness or joint-service has also served to increase outward military influence on foreign and national policy while decreasing the outright influence of local communities on military policy. Further research that studies levels of military influence and practices on national and local policies could prove timely during military transformations.

Further research should evaluate the role population density plays in determining the number of people affected by increasing levels of encroachment. This study approached population density calculations in two ways: 1) population based on changed land areas, 2) population based on constant land areas (refer to Appendix F). When population density is calculated based on changing size and shape of communities (pre-BRAC and post-BRAC), the population density may not increase or decrease with changes in population. However, when population density is calculated based on constant land areas (post-BRAC community size), population density consistently follows population variations. The outcome of this study indicates that population density, specifically the increase in community size pre-BRAC and post-

BRAC, is a determining factor of the potential number of people impacted by encroachment.

In summary, this study provides relational planning information that challenges conventional approaches to land use decisions, and provides groundwork for further research in a topic that has had limited research exposure. The relationship between the opinions of military and community planners and the empirical data of encroachment variables has important connections to issues in locally unwanted land uses. Previously, there has been limited research comparing real and perceived land use impacts from policy implementation. Also, there have been limited research connecting military and civilian perspectives about land area change. The fast rate of building development and change for both military installations and military communities signals the need to explore these findings about community planning and urban public policy.

APPENDIX A

LIST OF STUDY INSTALLATIONS AND COMMUNITIES

Installation	Community	Mean Population Pre-BRAC	Mean Population Post-BRAC	Mean Population Density Pre-BRAC (sq. mile)	Mean Population Density Post-BRAC (sq. mile)
White Sands Missile Range	Alamogordo, NM	23,530	31,589	1502.53	1762.20
Fort Belvoir	Alexandria, VA	107,078	119,733	8716.47	9050.67
Fort Richardson	Anchorage, AK	149,487	243,311	108.82	164.77
Twin Cities AAP	Arden Hills, Minnesota	6,820	9,426	949.21	1280.32
Fort McPherson	Atlanta, GA	460,998	417,914	93.01	84.58
Fort Gordon	Augusta, GA	53,698	119,911	27.10	22.53
Fort Custer	Augusta, Michigan	895	913	1183.46	1226.46
Camp Navajo	Bellemont Arizona	213	251	9.37	11.95
Fort Pickett	Blackstone, Virginia	3,518	3,586	960.12	954.39
Gowen Field and Orchard Range	Boise, Idaho	88,721	155,763	1718.77	2435.91
Camp Butner	Butner, NC	3,889	5,236	724.60	871.79
Camp Edwards	Cape Cod (Falmouth), MA	5,763	4,081	2110.90	1482.36
Carlisle Barracks	Carlisle, Pennsylvania	18,197	18,195	4139.81	4190.43
Fort Carson	Colorado Springs, CO	175,105	321,015	1164.75	1870.07
Fort Jackson	Columbia, SC	107,375	107,165	1059.42	967.43
Fort Benning	Columbus, GA	161,805	182,231	925.13	1021.63
Camp Grafton	Devils Lake, ND	7,260	7,502	1427.59	1530.23
Camp Fogarty	East Greenwich, Rhode Island	10,517	12,407	572.95	646.41
Fort Monmouth Main Post	Eatontown, NJ	13,661	13,904	2851.84	2880.86
Camp Atterbury	Edinburgh, Indiana	4,881	4,521	2121.49	1971.54
Biggs AAF	El Paso, TX	373,760	539,502	455.82	628.48
Fort Bliss	El Paso, TX	373,760	539,502	455.82	628.48
Fort Wainwright	Fairbanks, AK	18,708	30,534	725.57	1196.21
Fort Bragg	Fayetteville, NC	56,509	98,355	1188.05	1591.43
NTC and Fort Irwin	Fort Irwin, CA	3,141	3,800	91.36	105.28
Camp Grayling	Grayling, Michigan	1,968	1,948	1210.54	1196.08
Camp McCain	Grenada, Mississippi	11,293	12,872	465.82	448.14
Camp Guernsey	Guernsey, Wyoming	1,153	1,151	1325.03	1327.90

Fort Monroe	Hampton, Virginia	121,698	140,115	2903.77	3192.37
Fort Indiantown Gap	Harrisburg, PA	60,663	50,663	9241.44	7979.06
Camp Shelby	Hattiesburg, Mississippi	39,553	43,331	992.07	1050.49
Hawthorne Army Depot	Hawthorne, Nevada	3,640	3,737	3035.69	3471.02
Amedee AAF - Sierra Army Depot	Herlong, CA	1,253	993	18.09	15.28
Camp Dodge	Herrold, Iowa	4,236	5,364	185.76	222.87
West Point Mil Reservation	Highland Falls, New York	4,413	3,808	4930.67	4399.33
Fort Stewart	Hinesville, GA	7,712	25,998	587.54	1645.82
Fort Shafter	Honolulu, Hawaii	344,960	368,465	4973.10	5265.93
Fort Campbell	Hopkinsville, KY, Clarksville, TN	24,284	29,949	1248.80	1532.92
Fort Huachuca	Huachuca, AZ	1,660	1,767	732.76	786.62
Redstone Arsenal	Huntsville, Alabama	140,158	159,003	994.96	1134.32
Camp Ethan Allen	Jericho, Vermont	1,842	1,431	1582.66	1207.51
Fort Hood	Killeen, TX	40,902	75,223	1429.72	2220.88
Hunter Liggett	King City, CA	4,606	9,364	1554.31	2576.12
Holston AAP	Kingsport, TN	31,983	40,635	896.60	1019.46
Fort Lewis	Lakewood, Washington	55,079	58,312	3976.30	4216.92
Fort George G Meade	Laurel, MD	11,314	19,699	3697.94	6353.24
Fort Sill	Lawton, OK	77,262	86,659	1270.42	1324.66
Fort Leavenworth	Leavenworth, KS	29,402	36,958	1545.38	2023.34
Fort Polk	Leesville, LA	8,991	7,196	2037.71	1731.06
Camp Bullis	Leon Springs, TX	720,017	1,040,290	2182.75	2837.31
Camp Ripley	Little Falls, MN	6,812	7,476	16811.18	17848.99
Camp Parks	Livermore, CA	43,026	65,043	2222.06	2930.37
Fort Knox	Louisville, KY	329,962	262,647	6562.93	5351.66
Fort Riley	Manhattan, KS	30,110	41,272	2476.03	3101.21
McAlester AAP	McAlester, OK	18,029	17,077	1419.35	1288.78
Camp Crowder	Neosho, Missouri	8,505	9,880	703.77	765.74
Fort Hamilton	New York (Brooklyn), NY	2,456,000	2,382,995	42977.26	40259.05
Fort Eustis	Newport News, VI	141,540	175,098	2560.64	3076.33
Camp Robinson	North Little Rock, AR	62,164	61,087	1713.99	1702.33
Fort Rucker	Ozark, AL	13,372	14,021	482.44	466.22

Fort Dix	Pemberton, NJ, Fort Dix, NJ	1,110	1,289	2304.92	2839.86
Fort Lee	Petersburg, Virginia	38,579	36,063	2083.21	2072.78
Pine Bluff Arsenal	Pine Bluff, AR	57,013	56,113	1544.26	1547.71
Camp Beauregard	Pineville, Louisiana	10,493	13,040	1129.43	1318.72
Camp Perry	Port Clinton, Ohio	7,213	6,749	4230.49	4168.02
Rock Island Arsenal	Rock Island, Illinois	48,601	40,118	3770.83	3146.33
Fort Sam Houston	San Antonio, TX	720,017	1,040,290	2182.75	2837.31
Massachusetts Military Reservation	Sandwich, Massachusetts	5,242	3,028	1809.59	1035.04
Hunter Army Airfield	Savannah, Georgia	129,870	134,535	2146.81	2273.94
Fort McCoy	Sparta, Wisconsin	6,596	8,218	1491.02	1760.47
Fort Leonard Wood	St. Robert, Missouri	1,364	2,245	233.80	296.65
Camp Blanding	Starke, Florida	5,077	5,410	941.33	968.96
Tobyhanna Army Depot	Tobyhanna, PA	3,693	5,235	126.07	147.40
Tooele Army Depot	Tooele, Utah	13,437	18,195	785.34	811.64
Fort Story	Virginia Beach, Virginia	217,153	409,163	1080.57	1955.95
Schofield Barracks	Wahiawa, Hawaii	17,255	16,769	10088.02	10164.90
Camp Rilea	Warrenton, OR	2,522	3,389	712.24	757.15
Fort Drum	Watertown, NY	29,324	28,067	4044.73	4059.21
Yakima Training Center	Yakima, Washington	47,707	63,336	2928.84	3365.95
Yuma Proving Ground	Yuma, AZ	35,720	66,219	413.81	636.28

APPENDIX B

LIST OF INSTALLATIONS AND COMMUNITIES INVOLVED IN JOINT LAND USE STUDIES (JLUS)

Fort Richardson	Anchorage, AL
Fort Wainwright	Fairbanks, AL
NTC and Fort Irwin CA	Fort Irwin, CA
Fort Gordon	Augusta, GA
Fort Stewart	Hinesville, GA
Camp Dodge	Herrold, Iowa
Fort Riley	Manhattan, KS
Fort Knox	Louisville, KY
Camp Edwards	Cape Cod, Massachusetts
Camp Shelby	Hattiesburg, Mississippi
Fort Dix	Pemberton, NJ, Fort Dix, NJ
Fort Bliss	El Paso, NM
Fort Bragg	Fayetteville, NC
Fort Campbell dy	Hopkinsville, KY, Clarksville, TN
Camp Bullis	Leon Springs, TX
Tooele Army Depot	Tooele, Utah
Fort Lewis	Lakewood, Washington

APPENDIX C

DEFINITION OF TERMS

Definition of Terms

Terminology used in this paper is military in nature. Some of these terms include:

(Bolded acronyms are commonly used in relation to BRAC actions)

AAP Army Ammunition Plants

ACHP Advisory Council on Historic Preservation

ACUB Army Compatible Use Buffer

ADC Association of Defense Communities

AFB Air Force Base

AHPA Archeological and Historic Preservation Act

AICUZ Air Installation Compatible Use Zones

APA American Planning Association

APG Advanced Planning Grant

APZ Accident Potential Zones

AQCR Air Quality Control Region

ARNG Army National Guard

BCTO Base Closure and Transition Office

BCCRHAA Base Closure Community Redevelopment and Homeless Assistance Act

BCRA Defense Authorization Amendments and Base Closure and Realignment

BEC BRAC Environmental Coordinator

BLM Bureau of Land Management

BOQ Bachelor Officers Quarters

BRAC Base Realignment and Closure

CAA Clean Air Act (42 USC 7401)

CDBG Community Development Block Grant

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CEQ Council on Environmental Quality (Federal oversight of NEPA)

CFR Code of Federal Regulations

COE Corps of Engineers (Army)

COG Council of Government

CWA Clean Water Act

CZ Clear Zone

DBCRA Defense Base Closure and Realignment Act of 1990, Pub. L 101-510, as amended

DDESB Department of Defense Explosive Safety Board

DoD Department of Defense

DOI Department of the Interior

EA Environmental Assessment

EIS Environmental Impact Statement (NEPA Requirement)

EPA Environmental Protection Agency

ESA Endangered Species Act, 16 U.S.C. 1531-1544

EUL Enhanced Use Leasing

FIFRA Federal Insecticide, Fungicide and Rodenticide Act

FPD Federal Planning Division

GIS Geographical Information Systems

GSA General Services Administration

HCP Habitat Conservation Plan

IAG Interagency Agreement

ICMA International City/County Management Association

ICUZ Installation Compatible Use Zones (Army term)

JLUS – Joint Land Use System

LUCs Land Use Controls

MWR Morale, Welfare and Recreation

MXPD Mixed-Use Planned Development

NEPA National Environmental Policy Act of 1969, 42 U.S.C. 4321 *et seq*., as amended

NIMBY Not In My Backyard

NPL National Priorities List (EPA designation for highly contaminated sites)

NPS National Park Service

NZ Noise Zones

PDR Purchase of Development Rights

PONDS - Proactive Options with Neighbors for Defense-installation Sustainability

RCRA Resource Conservation and Recovery Act (1976 and beyond)

RRPI Readiness & Range Preservation Initiative

SDWA Safe Drinking Water Act, 42 U.S.C. 300f-300j-26

SHPO State Historic Preservation Office

SWOT Strengths, Weaknesses, Opportunities, Threats

TDR Transfer of Development Rights

TSCA Toxic Substances Control Act, 15 U.S.C. 2601-2671

ULI Urban Land Institute

U.S.C. United States Code

USFWS US Fish and Wildlife Service

USPS U.S. Park Service

UXO Unexploded Ordinance

WC Wildlife Conservation

WPFPA Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001 *et seq*

APPENDIX D

SURVEY QUESTIONNAIRE

University of Texas at Arlington - School of Urban and Public Affairs - U.S. Army Corps of Engineers

Military/Civilian Master Planners-
Thank you in advance for taking the time and effort to respond to this questionnaire. This survey is about post-BRAC encroachment, community-military base impacts, interactions, and community policies and planning. Please give your most candid and thorough responses to the questions below. Your information is confidential and will be blinded.

Military Installation Base and Community Encroachment Study

The survey is divided into three sections:

1. Your Employment Identifiers

2. Experience with Encroachment

3. Collaborative Planning Efforts and Encroachment Mitigation.

Please complete this questionnaire by 8 February 2008 for you to receive a summary of all responses by 15 February 2008.

1. Employment

My employer is:

- Military (Army)
- Civilian Employed by a Community
- Other:

My position is:

- Community Master Planner
- Military Master Planner
- Community Development Planner
- Economic Planner
- Planning Staff
- Other:

I have worked for the government or community in this position:

- Less than 5 Years
- 6 to 10 Years
- 11 to 20 Years
- More than 21 Years
- Other: ______

2. Experience with Encroachment

Common encroachment complaints are (check all that apply):

- Noise
- Light
- Air Quality (e.g. dust)
- Drainage
- Traffic Congestion
- Encroaching Growth (e.g. building proximity)
- Civilian Bandwidth Frequency
- Airspace Sharing
- Water Supply
- Habitat and Species Protection
- Security Problems
- Other: ______

My level of planning involvement in respect to encroachment issues:

- Involved
- Somewhat Involved
- Somewhat Not Involved
- Not Involved

The following base or community conflicts, static, or connection problems impact my installation or community (Check all that apply).

- Population Decrease
- Population Increase
- Light Level
- Training or Testing

- ☐ Noise Level
- ☐ Civilian Bandwidth Frequency
- ☐ Improper Drainage Pattern Issues
- ☐ Transportation Corridor Impacts
- ☐ Threatened and Endangered Species Protection Issues
- ☐ Base Housing Availability
- ☐ Community Housing Availability
- ☐ Civilian Employment Fluctuations
- ☐ Military Employment Fluctuations

- ☐ Other: ____

Present (Post-BRAC) Encroachment Levels and Causes

	Strongly Agree	Agree	Disagree	Strongly Disagree
BRAC Legislation causes an increase in encroachment complaints.	○	○	○	○
Encroachment is an issue for my community/installation	○	○	○	○
Noise Level (e.g. testing noise, training noise) is an issue for my community/installation.	○	○	○	○
Light Level (e.g. retail light) is an issue for my community/installation.	○	○	○	○
My community/installation is experiencing a population decrease after BRAC implementation.	○	○	○	○
My community/installation is experiencing population growth after BRAC implementation.	○	○	○	○
Transportation problems (e.g. traffic congestion) impact my community/installation.	○	○	○	○
My community/installation faces land encroachment problems (e.g. close proximity development) from community or military buildings or facilities.	○	○	○	○

3. Collaborative Planning Efforts/ Encroachment Mitigation Tools

Written planning communication(s) between military installation and local jurisdiction is:

- Between 1 to 5 per month
- Between 6 to 10 per month
- More than 11 per month
- None

Verbal/oral communication(s) between military installation and local jurisdiction about planning issues is:

- Between 1 and 5 per month
- Between 6 and 10 per month
- More than 11 per month
- None

For our collaborative planning, we engage in:

- [ ] Personal contact
- [ ] Meetings
- [ ] Information sharing
- [ ] Participation in planning boards or committees
- [ ] Public stakeholder meetings
- [ ] Conference phone calls
- [ ] Other: ________

In attempt to eliminate encroachment, we use these planning tools:

- [ ] JLUS - Joint Land Use Planning
- [ ] PONDS - Proactive Options with Neighbors for Defense-installation Sustainability
- [ ] Local Planning/Zoning Board Participation
- [ ] Planning Update Briefings
- [ ] ACUZ - Air-Installation Compatible Use Zone
- [ ] ACUB - Army Compatible Use Buffer Program
- [ ] Technological Tools (e.g. GIS Land Use Projections, Urban Growth Simulation)
- [ ] UGB - Urban Growth Boundaries Delineation
- [ ] Military Operation Tools (e.g. simulation in lieu of actual combat training)
- [ ] Comprehensive Plans
- [ ] Zoning Ordinances
- [ ] Subdivision Ordinances

☐ CIP - Capital Investment Plans
☐ Special District Ordinances
☐ GIS - Geographic Information Systems

☐ Other: ____

Communication and Involvement

	Strongly Agree	Agree	Disagree	Strongly Disagree
The current planning policies of my agency affect the amount of communication and coordination between military installations and communities.	○	○	○	○
I am adequately and properly informed of any major land use plan or decision by my community/installation.	○	○	○	○
It is likely my community/installation will become involved in a joint land use planning study.	○	○	○	○
The amount of interaction between my agency and my military or civilian counterparts is appropriate.	○	○	○	○

Finish Survey and Save Responses

APPENDIX E

STATISTICAL RESULTS

Regression Results

The following tables give the statistics of the regressions. Regression attempts to model the relationship between rate of population density change and rate of population change and the encroachment indicator variables. Rate of population density change and rate of population change are the independent variables. Noise decibel level, light level (in lumens), transportation impacts (travel time to work) are the encroachment indicator (dependent) variables in each of the procedures. Regression procedures also are run for the opinion data results for the same variables. The relationship may be caused by other influential variables (a lurking variable), due to low R 2 and the weakness of the models (only one model is significant).

1. Noise Level
Independent: Rate of Population Density
Dependent Variable: Noise Level

Opinion-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Noise Pollution Impacts	2.8194	.50657	80
Rate of Density	3.3544	95.96096	80

Correlations

		Noise Pollution Impacts	Rate of Density
Pearson Correlation	Noise Pollution Impacts	1.000	.027
	Rate of Density	.027	1.000
Sig. (1-tailed)	Noise Pollution Impacts	.	.407
	Rate of Density	.407	.
N	Noise Pollution Impacts	80	80
	Rate of Density	80	80

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Noise Pollution Impacts

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.027[a]	.001	-.012	.50962

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.015	1	.015	.056	.814[a]
	Residual	20.258	78	.260		
	Total	20.272	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Noise Pollution Impacts

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.819	.057		49.443	.000
	Rate of Density	.000	.001	.027	.236	.814

a. Dependent Variable: Noise Pollution Impacts

Empirical-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Rate of Decibel	7.0313	12.92685	80
Rate of Density	3.3544	95.96096	80

Correlations

		Rate of Decibel	Rate of Density
Pearson Correlation	Rate of Decibel	1.000	-.053
	Rate of Density	-.053	1.000
Sig. (1-tailed)	Rate of Decibel	.	.320
	Rate of Density	.320	.
N	Rate of Decibel	80	80
	Rate of Density	80	80

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Decibel

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.053[a]	.003	-.010	12.99103

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.366	1	37.366	.221	.639[a]
	Residual	13163.806	78	168.767		
	Total	13201.172	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Decibel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.055	1.453		4.855	.000
	Rate of Density	-.007	.015	-.053	-.471	.639

a. Dependent Variable: Rate of Decibel

2. Light
Independent: Rate of Population Density
Dependent Variable: Light

Opinion-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Light Pollution	2.1588	.84833	80
Rate of Density	3.3544	95.96096	80

Correlations

		Light Pollution	Rate of Density
Pearson Correlation	Light Pollution	1.000	.006
	Rate of Density	.006	1.000
Sig. (1-tailed)	Light Pollution	.	.481
	Rate of Density	.481	.
N	Light Pollution	80	80
	Rate of Density	80	80

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Light Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.006[a]	.000	-.013	.85374

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.002	1	.002	.002	.961[a]
	Residual	56.852	78	.729		
	Total	56.854	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Light Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.159	.096		22.601	.000
	Rate of Density	4.87E-005	.001	.006	.049	.961

a. Dependent Variable: Light Pollution

Empirical-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Rate Light Pollution	34.3115	50.37990	61
Rate of Density	4.0700	104.00549	61

Correlations

		Rate Light Pollution	Rate of Density
Pearson Correlation	Rate Light Pollution	1.000	-.089
	Rate of Density	-.089	1.000
Sig. (1-tailed)	Rate Light Pollution	.	.247
	Rate of Density	.247	.
N	Rate Light Pollution	61	61
	Rate of Density	61	61

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate Light Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.089[a]	.008	-.009	50.60172

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1216.585	1	1216.585	.475	.493[a]
	Residual	151071.5	59	2560.534		
	Total	152288.1	60			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate Light Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.488	6.484		5.319	.000
	Rate of Density	-.043	.063	-.089	-.689	.493

a. Dependent Variable: Rate Light Pollution

3. Transportation Impact

Independent: Rate of Population Density

Dependent Variable: Transportation Impact

Opinion-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Transportation Impacts	3.1094	.91821	80
Rate of Density	3.3544	95.96096	80

Correlations

		Transportation Impacts	Rate of Density
Pearson Correlation	Transportation Impacts	1.000	.029
	Rate of Density	.029	1.000
Sig. (1-tailed)	Transportation Impacts	.	.399
	Rate of Density	.399	.
N	Transportation Impacts	80	80
	Rate of Density	80	80

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Transportation Impacts

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.029[a]	.001	-.012	.92369

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.056	1	.056	.066	.799[a]
	Residual	66.550	78	.853		
	Total	66.605	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Transportation Impacts

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.108	.103		30.081	.000
	Rate of Density	.000	.001	.029	.256	.799

a. Dependent Variable: Transportation Impacts

Empirical-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Rate of Travel Time	25.0859	79.32195	74
Rate of Density	5.1393	98.26518	74

Correlations

		Rate of Travel Time	Rate of Density
Pearson Correlation	Rate of Travel Time	1.000	-.139
	Rate of Density	-.139	1.000
Sig. (1-tailed)	Rate of Travel Time	.	.119
	Rate of Density	.119	.
N	Rate of Travel Time	74	74
	Rate of Density	74	74

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Travel Time

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.139[a]	.019	.006	79.09388

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8893.253	1	8893.253	1.422	.237[a]
	Residual	450420.6	72	6255.842		
	Total	459313.9	73			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Travel Time

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.663	9.207		2.787	.007
	Rate of Density	-.112	.094	-.139	-1.192	.237

a. Dependent Variable: Rate of Travel Time

4. Building Level Rate

Independent: Rate of Population Density
Dependent Variable: Building Level Rate

Opinion -Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Building Level Increase post-BRAC	3.0458	1.01226	80
Rate of Density	3.3544	95.96096	80

Correlations

		Building Level Increase post-BRAC	Rate of Density
Pearson Correlation	Building Level Increase post-BRAC	1.000	.017
	Rate of Density	.017	1.000
Sig. (1-tailed)	Building Level Increase post-BRAC	.	.440
	Rate of Density	.440	.
N	Building Level Increase post-BRAC	80	80
	Rate of Density	80	80

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Building Level Increase post-BRAC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.017[a]	.000	-.013	1.01857

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.024	1	.024	.023	.880[a]
	Residual	80.924	78	1.037		
	Total	80.948	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Building Level Increase post-BRAC

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.045	.114		26.723	.000
	Rate of Density	.000	.001	.017	.151	.880

a. Dependent Variable: Building Level Increase post-BRAC

Empirical-Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Rate of Building Permit	-9.2929	92.53518	69
Rate of Density	.7319	99.06585	69

Correlations

		Rate of Building Permit	Rate of Density
Pearson Correlation	Rate of Building Permit	1.000	-.181
	Rate of Density	-.181	1.000
Sig. (1-tailed)	Rate of Building Permit	.	.068
	Rate of Density	.068	.
N	Rate of Building Permit	69	69
	Rate of Density	69	69

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Building Permit

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.181[a]	.033	.018	91.68208

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19092.204	1	19092.204	2.271	.136[a]
	Residual	563175.4	67	8405.604		
	Total	582267.6	68			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Building Permit

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-9.169	11.038		-.831	.409
	Rate of Density	-.169	.112	-.181	-1.507	.136

a. Dependent Variable: Rate of Building Permit

Regression Results
(Using Rate of Population Change)
Noise vs. Rate of Population

1. Noise Level
Independent: Rate of Population Change
Dependent Variable: Noise Level

Opinion-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Noise Pollution Impacts

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.030[a]	.001	-.012	.50958

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.018	1	.018	.069	.794[a]
	Residual	20.255	78	.260		
	Total	20.272	79			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Noise Pollution Impacts

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.811	.066		42.504	.000
	Rate PoP	.000	.001	.030	.262	.794

a. Dependent Variable: Noise Pollution Impacts

Empirical-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Decibel

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.005[a]	.000	-.013	13.00931

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.278	1	.278	.002	.968[a]
	Residual	13200.894	78	169.242		
	Total	13201.172	79			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Rate of Decibel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.997	1.688		4.145	.000
	Rate PoP	.001	.036	.005	.041	.968

a. Dependent Variable: Rate of Decibel

2. Light Level
Independent: Rate of Population Change
Dependent Variable: Light Level

Opinion-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Light Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.070[a]	.005	-.008	.85168

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.275	1	.275	.380	.540[a]
	Residual	56.578	78	.725		
	Total	56.854	79			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Light Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.193	.111		19.846	.000
	Rate PoP	-.001	.002	-.070	-.616	.540

a. Dependent Variable: Light Pollution

Empirical-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate Light Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.056[a]	.003	-.014	50.72548

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	476.663	1	476.663	.185	.668[a]
	Residual	151811.4	59	2573.075		
	Total	152288.1	60			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Rate Light Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32.600	7.615		4.281	.000
	Rate PoP	.063	.147	.056	.430	.668

a. Dependent Variable: Rate Light Pollution

2. Transportation Impacts
Independent: Rate of Population Change
Dependent Variable: Transportation Impacts

Opinion-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Transportation Impacts

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.090[a]	.008	-.005	.92035

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.535	1	.535	.632	.429[a]
	Residual	66.070	78	.847		
	Total	66.605	79			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Transportation Impacts

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.158	.119		26.439	.000
	Rate PoP	-.002	.003	-.090	-.795	.429

a. Dependent Variable: Transportation Impacts

Empirical-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Travel Time

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.261[a]	.068	.055	77.10489

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31262.076	1	31262.076	5.258	.025[a]
	Residual	428051.8	72	5945.164		
	Total	459313.9	73			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Rate of Travel Time

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.904	10.419		1.238	.220
	Rate PoP	.498	.217	.261	2.293	.025

a. Dependent Variable: Rate of Travel Time

2. Building Level Rate

Independent: Rate of Population Change
Dependent Variable: Building Level Rate

Opinion-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Building Level Increase post-BRAC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.154[a]	.024	.011	1.00664

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.909	1	1.909	1.884	.174[a]
	Residual	79.039	78	1.013		
	Total	80.948	79			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Building Level Increase post-BRAC

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.137	.131		24.013	.000
	Rate PoP	-.004	.003	-.154	-1.373	.174

a. Dependent Variable: Building Level Increase post-BRAC

Empirical-Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate PoP[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Building Permit

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.091[a]	.008	-.007	92.83899

a. Predictors: (Constant), Rate PoP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4789.440	1	4789.440	.556	.459[a]
	Residual	577478.2	67	8619.078		
	Total	582267.6	68			

a. Predictors: (Constant), Rate PoP

b. Dependent Variable: Rate of Building Permit

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-14.070	12.883		-1.092	.279
	Rate PoP	.197	.264	.091	.745	.459

a. Dependent Variable: Rate of Building Permit

Descriptive Statistics – Opinion Data

The following tables represent the descriptive statistics for the opinion survey data. The questions asked about post-BRAC opinions on a Likert scale with answers ranging from strongly disagree (1) to strongly agree (4). The mean for noise level impact opinion is 2.8194. The mean for light level opinion is 2.1588. The mean for transportation impact opinions is 3.1094. The mean for building level increase opinions is 3.0458. Finally, the mean for population increase post-BRAC opinions is 3.1458. All opinion based variables are highly correlated, meaning that correlation is significantly different from zero and are significant based on the two-tailed p-value. Inter-variable correlations are depicted in the correlation tables.

Descriptive Statistics

		Noise Level Impacts	Light Level	Transportation Impacts	Building Level Increase post-BRAC	Population Increase post-BRAC
N	Valid	80	80	80	80	80
	Missing	0	0	0	0	0
Mean		2.8194	2.1588	3.1094	3.0458	3.1458
Std. Error of Mean		.05664	.09485	.10266	.11317	.09923
Median		3.0000	2.0000	3.0000	3.0000	3.0000
Mode		3.00	2.00	4.00	4.00	4.00
Std. Deviation		.50657	.84833	.91821	1.01226	.88758
Variance		.257	.720	.843	1.025	.788
Minimum		2.00	1.00	1.00	1.00	1.00
Maximum		4.00	4.00	4.00	4.00	4.00

Noise Level Impacts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	19	23.8	23.8	23.8
	2.50	1	1.3	1.3	25.0
	3.00	52	65.0	65.0	90.0
	3.40	2	2.5	2.5	92.5
	3.50	3	3.8	3.8	96.3
	3.75	1	1.3	1.3	97.5
	4.00	2	2.5	2.5	100.0
	Total	80	100.0	100.0	

Light Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	19	23.8	23.8	23.8
	1.50	1	1.3	1.3	25.0
	2.00	31	38.8	38.8	63.8
	2.50	2	2.5	2.5	66.3
	3.00	22	27.5	27.5	93.8
	3.60	2	2.5	2.5	96.3
	4.00	3	3.8	3.8	100.0
	Total	80	100.0	100.0	

Transportation Impacts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	5	6.3	6.3	6.3
	2.00	14	17.5	17.5	23.8
	2.50	2	2.5	2.5	26.3
	3.00	24	30.0	30.0	56.3
	3.50	2	2.5	2.5	58.8
	3.75	1	1.3	1.3	60.0
	4.00	32	40.0	40.0	100.0
	Total	80	100.0	100.0	

Building Level Increase post-BRAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	8	10.0	10.0	10.0
	1.50	1	1.3	1.3	11.3
	2.00	13	16.3	16.3	27.5
	2.66	1	1.3	1.3	28.8
	3.00	21	26.3	26.3	55.0
	3.50	3	3.8	3.8	58.8
	4.00	33	41.3	41.3	100.0
	Total	80	100.0	100.0	

Population Increase post-BRAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	5	6.3	6.3	6.3
	2.00	11	13.8	13.8	20.0
	2.50	1	1.3	1.3	21.3
	3.00	29	36.3	36.3	57.5
	3.50	1	1.3	1.3	58.8
	3.66	1	1.3	1.3	60.0
	4.00	32	40.0	40.0	100.0
	Total	80	100.0	100.0	

Correlations

		Noise Level Impacts	Light Level	Transportation Impacts	Building Level Increase post-BRAC	Population Increase post-BRAC
Noise Level Impacts	Pearson Correlation	1	.632(**)	.611(**)	.672(**)	.387(**)
	Sig. (2-tailed)		.000	.000	.000	.000
	N	80	80	80	80	80
Light Level	Pearson Correlation	.632(**)	1	.746(**)	.820(**)	.625(**)
	Sig. (2-tailed)	.000		.000	.000	.000
	N	80	80	80	80	80
Transportation Impacts	Pearson Correlation	.611(**)	.746(**)	1	.849(**)	.696(**)
	Sig. (2-tailed)	.000	.000		.000	.000
	N	80	80	80	80	80
Building Level Increase post-BRAC	Pearson Correlation	.672(**)	.820(**)	.849(**)	1	.763(**)
	Sig. (2-tailed)	.000	.000	.000		.000
	N	80	80	80	80	80
Population Increase post-BRAC	Pearson Correlation	.387(**)	.625(**)	.696(**)	.763(**)	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	80	80	80	80	80

** Correlation is significant at the 0.01 level (2-tailed).

Cross-Tabulation Analysis

The following tables depict the results of the contingency table and the chi-square test. After completion of the paired samples t-test and the opinion survey, a contingency table determines association between the outcomes of the empirical and opinion variables. Each survey response is linked to the corresponding community/installation. Empirical data is converted to ordinal level for comparison. The contingency tables (Chi-square) analysis shows that only one of the five encroachment indicator variables is significant at the .05 level.

1. Post Building Level vs. Opinion Building Level data

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Building Level Increase post-BRAC * Changed Ordinal for Building	69	100.0%	0	.0%	69	100.0%

Building Level Increase post-BRAC * Changed Ordinal for Building Crosstabulation

			Changed Ordinal for Building				Total
			1	2	3	4	
Building Level Increase post-BRAC	1.00	Count	2	1	3	0	6
		% within Changed Ordinal for Building	12.5%	5.6%	17.6%	.0%	8.7%
		Adjusted Residual	.6	-.5	1.5	-1.5	
	1.50	Count	0	0	0	1	1
		% within Changed Ordinal for Building	.0%	.0%	.0%	5.6%	1.4%
		Adjusted Residual	-.6	-.6	-.6	1.7	
	2.00	Count	2	3	3	4	12
		% within Changed Ordinal for Building	12.5%	16.7%	17.6%	22.2%	17.4%
		Adjusted Residual	-.6	-.1	.0	.6	
	2.66	Count	0	1	0	0	1
		% within Changed Ordinal for Building	.0%	5.6%	.0%	.0%	1.4%
		Adjusted Residual	-.6	1.7	-.6	-.6	
	3.00	Count	4	3	6	5	18
		% within Changed Ordinal for Building	25.0%	16.7%	35.3%	27.8%	26.1%
		Adjusted Residual	-.1	-1.1	1.0	.2	
	3.50	Count	2	0	1	0	3
		% within Changed Ordinal for Building	12.5%	.0%	5.9%	.0%	4.3%
		Adjusted Residual	1.8	-1.1	.4	-1.1	
	4.00	Count	6	10	4	8	28
		% within Changed Ordinal for Building	37.5%	55.6%	23.5%	44.4%	40.6%
		Adjusted Residual	-.3	1.5	-1.6	.4	
Total		Count	16	18	17	18	69
		% within Changed Ordinal for Building	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.348[a]	18	.499
Likelihood Ratio	19.135	18	.384
Linear-by-Linear Association	.072	1	.788
N of Valid Cases	69		

a. 24 cells (85.7%) have expected count less than 5. The minimum expected count is .23.

2. Post Light Level data vs. Opinion Light

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Light Pollution * Changed Ordinal for Light	62	100.0%	0	.0%	62	100.0%

Light Pollution * Changed Ordinal for Light Crosstabulation

			Changed Ordinal for Light				Total
			1	2	3	4	
Light Pollution	1.00	Count	7	2	3	4	16
		% within Changed Ordinal for Light	46.7%	12.5%	20.0%	25.0%	25.8%
		Adjusted Residual	2.1	-1.4	-.6	-.1	
	1.50	Count	0	1	0	0	1
		% within Changed Ordinal for Light	.0%	6.3%	.0%	.0%	1.6%
		Adjusted Residual	-.6	1.7	-.6	-.6	
	2.00	Count	4	8	7	5	24
		% within Changed Ordinal for Light	26.7%	50.0%	46.7%	31.3%	38.7%
		Adjusted Residual	-1.1	1.1	.7	-.7	
	2.50	Count	0	0	0	2	2
		% within Changed Ordinal for Light	.0%	.0%	.0%	12.5%	3.2%
		Adjusted Residual	-.8	-.8	-.8	2.4	
	3.00	Count	3	5	5	2	15
		% within Changed Ordinal for Light	20.0%	31.3%	33.3%	12.5%	24.2%
		Adjusted Residual	-.4	.8	.9	-1.3	
	3.60	Count	0	0	0	2	2
		% within Changed Ordinal for Light	.0%	.0%	.0%	12.5%	3.2%
		Adjusted Residual	-.8	-.8	-.8	2.4	
	4.00	Count	1	0	0	1	2
		% within Changed Ordinal for Light	6.7%	.0%	.0%	6.3%	3.2%
		Adjusted Residual	.9	-.8	-.8	.8	
Total		Count	15	16	15	16	62
		% within Changed Ordinal for Light	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.631[a]	18	.167
Likelihood Ratio	23.501	18	.172
Linear-by-Linear Association	1.426	1	.232
N of Valid Cases	62		

a. 24 cells (85.7%) have expected count less than 5. The minimum expected count is .24.

3. Post Noise Data (decibel) vs. Opinion Noise

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Noise Pollution Impacts * Post-Decibel	75	100.0%	0	.0%	75	100.0%

Noise Pollution Impacts * Post-Decibel Crosstabulation

			Post-Decibel					Total
			80	100	130	140	160	
Noise Pollution Impacts	2.00	Count	1	2	10	3	0	16
		% within Post-Decibel	3.2%	12.5%	50.0%	42.9%	.0%	21.3%
		Adjusted Residual	-3.2	-1.0	3.7	1.5	-.5	
	2.50	Count	0	1	0	0	0	1
		% within Post-Decibel	.0%	6.3%	.0%	.0%	.0%	1.3%
		Adjusted Residual	-.8	1.9	-.6	-.3	-.1	
	3.00	Count	27	12	9	3	0	51
		% within Post-Decibel	87.1%	75.0%	45.0%	42.9%	.0%	68.0%
		Adjusted Residual	3.0	.7	-2.6	-1.5	-1.5	
	3.40	Count	2	0	0	0	0	2
		% within Post-Decibel	6.5%	.0%	.0%	.0%	.0%	2.7%
		Adjusted Residual	1.7	-.7	-.9	-.5	-.2	
	3.50	Count	0	0	1	1	1	3
		% within Post-Decibel	.0%	.0%	5.0%	14.3%	100.0%	4.0%
		Adjusted Residual	-1.5	-.9	.3	1.5	4.9	
	3.75	Count	1	0	0	0	0	1
		% within Post-Decibel	3.2%	.0%	.0%	.0%	.0%	1.3%
		Adjusted Residual	1.2	-.5	-.6	-.3	-.1	
	4.00	Count	0	1	0	0	0	1
		% within Post-Decibel	.0%	6.3%	.0%	.0%	.0%	1.3%
		Adjusted Residual	-.8	1.9	-.6	-.3	-.1	
Total		Count	31	16	20	7	1	75
		% within Post-Decibel	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.906[a]	24	.000
Likelihood Ratio	41.731	24	.014
Linear-by-Linear Association	9.828	1	.002
N of Valid Cases	75		

a. 31 cells (88.6%) have expected count less than 5. The minimum expected count is .01.

4. Opinion Post Population increase vs. Growth Rate of Population

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Population Increase post-BRAC * Changed ordinal fpr rate pop	80	100.0%	0	.0%	80	100.0%

Population Increase post-BRAC * Changed ordinal fpr rate pop Crosstabulation

			Changed ordinal fpr rate pop				Total
			1	2	3	4	
Population Increase post-BRAC	1.00	Count	2	0	1	2	5
		% within Changed ordinal fpr rate pop	10.0%	.0%	5.0%	10.0%	6.3%
		Adjusted Residual	.8	-1.3	-.3	.8	
	2.00	Count	4	2	3	2	11
		% within Changed ordinal fpr rate pop	20.0%	10.0%	15.0%	10.0%	13.8%
		Adjusted Residual	.9	-.6	.2	-.6	
	2.50	Count	0	0	1	0	1
		% within Changed ordinal fpr rate pop	.0%	.0%	5.0%	.0%	1.3%
		Adjusted Residual	-.6	-.6	1.7	-.6	
	3.00	Count	7	9	5	8	29
		% within Changed ordinal fpr rate pop	35.0%	45.0%	25.0%	40.0%	36.3%
		Adjusted Residual	-.1	.9	-1.2	.4	
	3.50	Count	0	0	0	1	1
		% within Changed ordinal fpr rate pop	.0%	.0%	.0%	5.0%	1.3%
		Adjusted Residual	-.6	-.6	-.6	1.7	
	3.66	Count	1	0	0	0	1
		% within Changed ordinal fpr rate pop	5.0%	.0%	.0%	.0%	1.3%
		Adjusted Residual	1.7	-.6	-.6	-.6	
	4.00	Count	6	9	10	7	32
		% within Changed ordinal fpr rate pop	30.0%	45.0%	50.0%	35.0%	40.0%
		Adjusted Residual	-1.1	.5	1.1	-.5	
Total		Count	20	20	20	20	80
		% within Changed ordinal fpr rate pop	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.657[a]	18	.685
Likelihood Ratio	15.125	18	.653
Linear-by-Linear Association	.115	1	.735
N of Valid Cases	80		

a. 20 cells (71.4%) have expected count less than 5. The minimum expected count is .25.

5. Post Transportation vs. Opinion transportation data

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Transportation Impacts * Changed Ordinal for transportation	74	100.0%	0	.0%	74	100.0%

Transportation Impacts * Changed Ordinal for transportation Crosstabulation

			Changed Ordinal for transportation				Total
			1	2	3	4	
Transportation Impacts	1.00	Count	1	2	1	1	5
		% within Changed Ordinal for transportation	5.6%	10.5%	5.9%	5.0%	6.8%
		Adjusted Residual	-.2	.8	-.2	-.4	
	2.00	Count	3	4	3	2	12
		% within Changed Ordinal for transportation	16.7%	21.1%	17.6%	10.0%	16.2%
		Adjusted Residual	.1	.7	.2	-.9	
	2.50	Count	2	0	0	0	2
		% within Changed Ordinal for transportation	11.1%	.0%	.0%	.0%	2.7%
		Adjusted Residual	2.5	-.8	-.8	-.9	
	3.00	Count	2	7	7	7	23
		% within Changed Ordinal for transportation	11.1%	36.8%	41.2%	35.0%	31.1%
		Adjusted Residual	-2.1	.6	1.0	.4	
	3.50	Count	0	1	1	0	2
		% within Changed Ordinal for transportation	.0%	5.3%	5.9%	.0%	2.7%
		Adjusted Residual	-.8	.8	.9	-.9	
	3.75	Count	0	0	0	1	1
		% within Changed Ordinal for transportation	.0%	.0%	.0%	5.0%	1.4%
		Adjusted Residual	-.6	-.6	-.5	1.7	
	4.00	Count	10	5	5	9	29
		% within Changed Ordinal for transportation	55.6%	26.3%	29.4%	45.0%	39.2%
		Adjusted Residual	1.6	-1.3	-.9	.6	
Total		Count	18	19	17	20	74
		% within Changed Ordinal for transportation	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.159[a]	18	.445
Likelihood Ratio	18.971	18	.394
Linear-by-Linear Association	.192	1	.661
N of Valid Cases	74		

a. 20 cells (71.4%) have expected count less than 5. The minimum expected count is .23.

APPENDIX F

GEOGRAPHIC MEASUREMENT OF POPULATION DENSITY
BASED ON CONSTANT MEASUREMENT AREAS
STATISTICAL RESULTS

Regression Results

The following tables depict the results of the regression procedures using constant, post-BRAC (2000) geographic area of the community/installation. Rate of population density change is the independent variables. Noise decibel level, light level (in lumens), transportation impacts (travel time to work) are the encroachment indicator (dependent) variables in each of the procedures. Using this type of measurement for population density does not change the regression results. Due to the low R 2 and weakness of the models the relationship may be caused by other influential variables (a lurking variable).

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Decibel

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.003[a]	.000	-.013	13.00941

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.089	1	.089	.001	.982[a]
	Residual	13201.083	78	169.245		
	Total	13201.172	79			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Decibel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.015	1.623		4.322	.000
	Rate of Density	.001	.049	.003	.023	.982

a. Dependent Variable: Rate of Decibel

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate Light Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.027[a]	.001	-.016	50.78717

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	107.198	1	107.198	.042	.839[a]
	Residual	152180.9	59	2579.337		
	Total	152288.1	60			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate Light Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.978	7.278		4.806	.000
	Rate of Density	-.040	.197	-.027	-.204	.839

a. Dependent Variable: Rate Light Pollution

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Building Permit

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.017[a]	.000	-.015	93.20985

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	166.516	1	166.516	.019	.890[a]
	Residual	582101.1	67	8688.076		
	Total	582267.6	68			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Building Permit

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.545	12.453		-.686	.495
	Rate of Density	-.049	.355	-.017	-.138	.890

a. Dependent Variable: Rate of Building Permit

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Travel Time

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.131[a]	.017	.003	79.18656

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7837.068	1	7837.068	1.250	.267[a]
	Residual	451476.8	72	6270.512		
	Total	459313.9	73			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Travel Time

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	30.242	10.296		2.937	.004
	Rate of Density	-.335	.300	-.131	-1.118	.267

a. Dependent Variable: Rate of Travel Time

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Rate of Density[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Rate of Noise Pollution

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.269[a]	.072	.060	95.33511

a. Predictors: (Constant), Rate of Density

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51823.070	1	51823.070	5.702	.020[a]
	Residual	663481.1	73	9088.782		
	Total	715304.2	74			

a. Predictors: (Constant), Rate of Density

b. Dependent Variable: Rate of Noise Pollution

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.970	12.201		-.735	.465
	Rate of Density	.876	.367	.269	2.388	.020

a. Dependent Variable: Rate of Noise Pollution

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