

## *Appendix 7*

### *7.0 Sample Easements, Trusts, Memorandum of Agreement, Noise/Property Agreements, Open Space Acquisition*

#### *7.1 Sample Avigation Easement*

#### *7.2 Utah Code Title 63 CH. 49A - Military Base Easements*

#### *7.3 Sample Easement and Trust*

#### *7.4 Sample Memorandum of Understanding*

#### *7.5 Sample Noise/Property Agreement*

#### *7.6 State of North Carolina*



## Appendix 7.1

**This sample easement was developed from an existing easement used by a local government in Florida and has been successfully used as a pattern by other local governments.**

### SAMPLE AVIGATION EASEMENT

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

CITY OF \_\_\_\_\_

THIS INDENTURE, dated this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_,

by and between \_\_\_\_\_, hereinafter called GRANTOR, and [County/City] a [political subdivision or municipality] of the State of Florida, hereinafter called GRANTEE.

WHEREAS, the GRANTOR is the owner of certain premises situate, lying and being in the [County/City] of \_\_\_\_\_ Florida, as hereinafter described; and

WHEREAS, the GRANTEE, is the owner and operator of the \_\_\_\_\_ Airport located in the [County/City] of \_\_\_\_\_, Florida.

NOW, THEREFORE, in consideration of [Ten Dollars (\$10.00)] and other good and valuable consideration paid by the GRANTEE to the GRANTOR, the receipt of which is hereby acknowledged, the GRANTOR does hereby grant and convey unto the GRANTEE, its successors and assigns, an easement and right-of-way for the over-flight of aircraft in and through the airspace above the following described property located within

\_\_\_\_\_ [County/City], to wit:

[Property Description]

The GRANTOR hereby gives and grants to the GRANTEE, its successors and assigns, and to all persons lawfully using said airport, the right and easement to use the airspace above the GRANTOR'S property and to create noise normally associated with the routine operation of aircraft and for avigation purposes and without liability for any necessary, convenient or operational incident, the effects thereof whether as the same presently or in the future exist, but said right or easement hereby granted is to be executed only in a manner reasonably or substantially consistent with the safe and proper flying procedures promulgated by any agency of the government of the United States or the State of Florida.

The rights and easements hereby granted and conveyed, and the covenants hereby entered into, shall not be construed to deprive the GRANTOR of any claims for injury or damages against any person for negligence whereby injury or damage is caused by actual or direct physical contact, without intervening media, but shall operate and constitute a full, complete and total release, quit claim and discharge of the GRANTEE, its successors and assigns, its agents and employees, and all persons lawfully using said airport and the

owners and operations of aircraft lawfully using the airspace hereby conveyed, from all claims and demands whatever, not solely and proximately resulting from negligent actual or direct physical contact, it being the intent of the GRANTOR herein to waive its right to suit for nuisance and noise incident to the operation of the [Name] Airport by the GRANTEE herein.

All rights, easements, releases, benefits and estates granted hereunder shall be covenants running with the land as is hereinabove described.

In the event the GRANTEE abandons the operation of said airport, all rights herein granted shall cease and revert to the GRANTOR, his successors or assigns.

IN WITNESS WHEREOF, said GRANTOR in pursuance to his due and legal action, has executed these presents, as of the date first above written.

\_\_\_\_\_  
GRANTOR

WITNESSETH:

\_\_\_\_\_

WITNESSETH:

\_\_\_\_\_

STATE OF FLORIDA

COUNTY OF \_\_\_\_\_

THE FOREGOING instrument was acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_, by \_\_\_\_\_ GRANTOR, who is personally known to me or who has produced \_\_\_\_\_ [type of identification] as identification and who did (or did not) take an oath.

\_\_\_\_\_  
Signature of Notary

Typed/Printed Name of Notary

\_\_\_\_\_  
Title

My Commission Expires: \_\_\_\_\_

Source: Florida Department of Transportation, Aviation Office. "Airport Compatible Land Use Guidance for Florida Communities." 1994.

## Appendix 7.2

### Utah Code -- Title 63 -- Chapter 49a -- Military Base Easements

**63-49a-1. Acquisition of easements -- Restrictions -- Resale.** (1) (a) The Department of Community and Economic Development shall acquire, by purchase or condemnation, easements for the establishment, maintenance, and operation of a restrictive use area for the operation of aircraft to and from Hill Air Force Base because:

(i) Hill Air Force Base is a military installation of vital importance to security of the United States of America and to the economic well-being of the citizens of Utah;

(ii) there are certain portions of land around the entire base that are being developed for residential and other uses that are incompatible with current and future operations of the base because of noise, health, safety, and accident reasons; and

(iii) it is the purpose of this chapter for the state to acquire those easements restricting the use of those lands and the air space above them in order to assure the continued operation of Hill Air Force Base as an active military base and to protect the health, safety, and economic well-being of the citizens of Utah.

(b) The Department of Community and Economic Development may delegate its power to purchase or condemn easements under this subsection to other state agencies if the department ensures that those agencies comply with the procedures and requirements of this chapter.

(2) (a) The Department of Community and Economic Development shall ensure that the easements restrict the land from those uses identified in the Hill Air Force Base AICUZ Land Use Compatibility Guidelines Study, as amended, dated October, 1982, as not being acceptable.

(b) The Department of Community and Economic Development may allow certain other uses not prohibited by those guidelines if those uses are consistent with the purpose of this chapter.

(c) Nothing in this chapter may be construed to authorize the Department of Community and Economic Development or any other state agency to:

(i) acquire any ownership interest in real property other than an easement restricting the land from future uses inconsistent with the Hill Air Force Base AICUZ Land Use Compatibility Guidelines Study, as amended, dated October 1982;

(ii) purchase businesses; or

(iii) require people to relocate or move from their property.

(d) To calculate the purchase price for the easements, the Department of Community and Economic Development shall subtract the market value of the real property and its improvements after the acquisition of the easements from the market value of the real property and its improvements before the acquisition of the easements.

(e) When the Hill Air Force Base runways have not been used for seven years to accommodate the arrival and departure of airplanes, the Department of Community and Economic Development shall:

(i) notify by certified mail each current owner of the property to which each easement is attached;

(ii) inform that owner that the owner may purchase the easement from the state for the same price that the state paid for it originally or for the market value of the easement at the time of the buyback, whichever is smaller; and

(iii) sell the easement to the owner of the property to which the easement is attached if the owner tenders the purchase price.

(f) In addition to purchasing the easements required by this chapter, the Department of Community and Economic Development may provide reasonable relocation expenses to all churches, businesses, and schools that, as of March 1, 1994, were located either within the north Hill Air Force Base accident potential zone (APZ) identified in Subsection 63-49a-2(1)(a) or within the south Hill Air Force Base accident potential zone (APZ) identified in Subsection 63-49a-2(1)(b) if those churches, businesses, and schools *can* reasonably demonstrate that expansion of the use would have been permitted before acquisition of the easements but is now prohibited because of the easement.

(3) (a) The Department of Community and Economic Development may take action to enforce the provisions of this chapter.

(b) The attorney general shall represent the Department of Community and Economic Development in that action.

Enacted by Chapter 255, 1994 General Session

63-49a-2. **Location of Easements.** (1) The Department of Community and Economic Development or its designees may acquire easements on the land within the following boundaries:

(a) Beginning on the north Hill Air Force Base accident potential zone (APZ) at a point which is North 1,089,743.170 meters and East 459,346.946 meters based on the North zone, State of Utah, NAD 83 coordinates and runs north to North 63 degrees 10 minutes 44 seconds, East 457.109 meters, North 26 degrees 49 minutes 16 seconds, West 3,352.129 meters, South 63 degrees 10 minutes 44 seconds, West 914.217 meters, South 26 degrees 49 minutes 16 seconds, East 3,352.129 meters, North 63 degrees 10 minutes 44 seconds, East 457.109 meters back to the point of beginning; and (b) beginning on the south Hill Air Force Base APZ which is North 1,086,065.786 meters and East 46 1,206.222 meters based on the North zone, State of Utah, NAD 83 coordinates and runs South 63 degrees 10 minutes 44 seconds, West 457.109 meters, South 26 degrees 49 minutes 16 seconds, East 502.179 meters, South 0 degrees 20 minutes 35 seconds, West 1,722.227 meters, South 89 degrees 39 minutes 25 seconds, East 883.743 meters, North 63 degrees 10 minutes 44 seconds, East 914.2 17 meters, North 26 degrees 49 minutes 16 seconds, West 2,437.9 12 meters, South 63 degrees 10 minutes 44 seconds, West 457.109 meters back to the point of beginning.

(2) The Department of Community and Economic Development or its designees may acquire easements on the following land that is located inside the 75 and 80 level day-night (LDN) noise contour as identified in the Hill Air Force Base AICUZ Land Use Compatibility Guidelines Study, as amended, dated October, 1982:

- (a) in the west half of Section 3, T4NR1W;
- (b) in the east half of Section 4, T4NR1W;
- (c) in the northeast quarter of Section 8, T4NR1 W;
- (d) within all of Section 9, T4NR1W;
- (e) in the northwest quarter of Section 10, T4NR1W;
- (f) within the southwest quarter of Section 19, T5NR1W;
- (g) in the south half of Section 20, T5NIR1W;

(h) within the southwest quarter of Section 28, TSNRIW; and (i) within Section 29, T5NRIW.

Enacted by Chapter 255, 1994 General Session

**63-49a-3. Certain improvements, alterations, and expansions prohibited.**

(1) A person or entity may not begin to develop, or authorize development, on any land identified in this chapter until whichever of the following occurs first:

(a) May 31, 1995; or

(b) the Department of Community and Economic Development has affirmatively authorized the development of the land because the development is consistent with those uses identified in the Hill Air Force Base AICUZ Land Use Compatibility Guidelines Study, as amended, dated October 1982.

(2) Nothing in this chapter prohibits any property owner from improving, altering, or expanding any existing residential or commercial use of his property so long as the improvement, alteration, or expansion does not materially increase the human density of that present use.

Amended by Chapter 31, 1995 General Session



## *Appendix 7.3*

### **EASEMENTS AND TRUSTS**

#### **DEFINITION**

An easement is an exchange of a property right(s) between the owner of property and an interested party. An easement or trust is a legal instrument used to execute and record an agreement between a grantor and a grantee in exchange for the right to access and use the property pursuant to terms and conditions mutually agreed to by the involved parties. It may include access rights to the grantee such as a utility easement or a public right-of-way easement. Or it could extend to restrictions on the future use of the land. Compensation is normally exchanged between the parties unless it is a voluntary dedication by the owner. The form of compensation may vary depending upon the circumstances under which the easement is granted and the condition(s).

A conservation trust involves the donation or sale of land by its owner for a specified period of time during which the property is held in trust, after which ownership may revert back to the donator or whoever is the designee.

#### **CHARACTERISTICS**

Easements are property rights or privileges generally obtained through purchase agreements that are recorded with the deed. An easement may also be obtained through eminent domain proceedings. Easements may be negative, wherein one owner can specify how the other may use the property, or positive, whereby one owner has the right to use all or part of another's property without restriction. In either case, only the rights, and not the property itself, are transferred.

Easements can be considered another form of land use control. The difference rests in the fact that there may be dependence on local government police powers to implement or to enforce.

Rights of easements are often obtained for a price that could be less than fair market value when compared to the full value of the property.

In both easements and trusts, the grantor may be relieved of the burden of property taxes, in whole or in part, and may be able to deduct the land value from taxes. It depends on the nature of the easement, the location, and the prevailing laws of the local jurisdiction.

#### **APPLICATION**

Easements may be used in several ways relative to military installations. If land surrounding an installation is undeveloped, then negative easements can be sought either by the military installation or the local government to prevent incompatible development. If existing development is in place then positive easements (*i.e.*, noise disclosure) can be used.

### **POSITIVE FEATURES**

Easement purchases are straightforward transactions, and generally less expensive than fee simple purchase. It can permit an installation to retain control over adjacent land without the burden of actual ownership.

### **NEGATIVE FEATURES**

Because cooperation is required, it may be difficult to obtain a desired easement. This may be particularly significant where multiple property owners are involved. Unless otherwise specified in the easement agreement, the rights are not automatically transferred upon resale of the land, so further negotiations may be required.

### **LEGAL STANDING**

Properly worded agreements for the purchase of easements, or the granting of trusts, are enforceable in the court. However, care should be taken to specify terms and conditions of the grant, including the time period (if any) and an exact description (meets and bounds) of the land under which the easement is sought.

*Appendix 7.4*

MEMORANDUM OF UNDERSTANDING  
 BETWEEN  
 \_\_\_\_\_  
 \_\_\_\_\_ [Military Installation],  
 \_\_\_\_\_ COUNTY  
 AND  
 THE CITY OF \_\_\_\_\_

This Memorandum of Understanding between [Military installation] and the City of \_\_\_\_\_, and [County] is enacted to establish a mutually beneficial process that will ensure timely and consistent notification and cooperation between the parties on projects, policies, and activities. These parties have a mutual interest in the cooperative evaluation, review, and coordination of local plans, programs, and projects of the city of \_\_\_\_\_, \_\_\_\_\_ County, and [Military Installation].

The City of \_\_\_\_\_, and \_\_\_\_\_ County agree to:

1. Submit information to the [Military Installation] Community Planner on plans, programs, actions, and projects which may affect [Military Installation]. This may include, but is not limited to, the following:
  - a. Development proposals
  - b. Transportation improvements and plans
  - c. Sanitary waste facilities
  - d. Open space and recreation
  - e. Public works projects
  - f. Solid waste management proposals
  - g. Land use plans and ordinances
  - h. Rezoning and variances
  - i. Subdivisions
  
2. Submit to the [Military Installation] Community Planner for review and comment, project notification, policies, plans, projects, reports, studies, and similar information on land, facility, and environmental activities within the vicinity of Fort Campbell as identified on the map in attachment 1.
  
3. Incorporate [Military Installation] comments into local responses and reports or, if not accepted, submit written explanation stating reasons comments will not be incorporated at least 5 days prior to the decision.
  
4. Include the [Military Installation] Community Planner in the distribution of meeting agendas for, but not limited to, the following:
  - a. \_\_\_\_\_ City Council
  - b. \_\_\_\_\_ County Commission

- c. \_\_\_\_\_ Planning Commission
- d. \_\_\_\_\_ Zoning Board of Adjustment
- f. \_\_\_\_\_ Review Board
- g. \_\_\_\_\_ Urban Transportation Study Committee

[Military Installation] agrees to:

1. Submit information to the city and county Planning Director on plans, programs, actions, and projects which may affect the city or county. These may include, but are not limited to, the following:

- a. Installation Master Plans
- b. Withdrawal of public domain land for military use
- c. Installation Compatible Use Zone Studies (ICUZ)
- d. Substantial changes in existing installation use
- e. Appropriate data for local plans, programs, and projects

2. Submit to the city and county Planning Director for review, policies, plans, projects, reports, studies and similar information on land, facility, and environmental activities at [Military Installation].

This agreement will remain in effect until terminated by any of the parties. Amendments to this memorandum may be made by mutual agreement of all the parties. Review process details and appropriate forms may be developed to facilitate uniform and efficient exchange of comments. This agreement will not be construed to obligate the U.S. Army, the city of

\_\_\_\_\_ County, or \_\_\_\_\_ Planning Commission to violate existing or future laws or regulations.

This agreement is approved by:

\_\_\_\_\_ County

[Military Installation] \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

The city of \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix 7.5

### **SAMPLE NOISE/PROPERTY AGREEMENT**

Undersigned, the Undersigned covenants and agree as follows:

1. That the Undersigned acknowledges that the Undersigned is aware that the *property is* located in a high noise area due to its proximity to Fort Campbell and the operations of the USA at and around Fort Campbell. The Undersigned further acknowledges that such noise will, in all likelihood, continue indefinitely into the future and might, in fact, increase significantly.

2. That the undersigned for the Undersigned and the heirs, successors, assigns and personal representatives of the Undersigned, has granted and conveyed and by these presents does grant and convey unto the USA a perpetual easement to cause noise in any level of intensity caused by operations at Fort Campbell for the use of aircraft and weapons at Fort Campbell, in the vicinity of Fort Campbell, or in the vicinity of the property to be heard upon the property, to have and to hold the said easement unto the USA, forever.

3. The Undersigned is aware of recent enacted noise attenuation requirements imposed by one or more ordinances recently enacted by the county, which requirements effect construction on the property after the date of enactment, and acknowledge awareness of the fact that it is necessary and beneficial to the undersigned to comply therewith, agree to comply therewith, and agree to furnish any future purchaser, tenant, or occupant of the property, a copy of this instrument and to make such persons aware of the noise to which the property is now and might in the future be subject, the noise attenuation requirements imposed on the property, and that the provisions of this instrument are binding on such persons.

4. That no deed or plat of the property or any portion thereof shall be drawn, made, used or recorded unless there is noted on such deed or plat that the portion of the property described or represented therein in the latest report issued by Fort Campbell or unless such deed or plat contained a statement accurately reflecting that no portion of the property described or shown therein is within the 65 dB noise contour.

5. That the Undersigned, for the Undersigned and the heirs, successors, assigns or personal representatives of the Undersigned, hereby releases the USA and all of its officials, officers, agents, servants, employees, contractors, invitees, and permittees from any and all claims, damages, or causes of action for personal injury, property damage, or of any other nature whatsoever, whether known or unknown, direct or indirect, foreseen or unforeseen, that the Undersigned or the heirs, assigns, successors, personal representatives, tenants, invitees, or permittees of the Undersigned might have in the past or might *in the future* sustain due to noise from Fort Campbell or the aircraft and weapons operated there from or in the vicinity thereof.

6. That the restrictions herein imposed on the Property, releases herein granted, and the agreements herein made shall be binding upon the Undersigned, the heirs, assigns, successors, personal representatives, tenants, invitees, and permittees of the Undersigned and shall run with the title to the property.

7. That these covenants may be enforced by the USA, the County, the Undersigned, or any person owning any lot in Christian County as shown on the Plat.

8. That a violation of the covenants imposed herein *shall* not result in a *forfeiture* or reversion of title.

9. The restrictions imposed by this instrument may be canceled by the USA. However the restrictions imposed on the Property by this instrument shall remain in full force and effect until canceled by the USA or until the USA ceases to use Fort Campbell as a military installation for a continuous period of more than one (1) year.

In witness whereof, the Undersigned has signed, sealed, and delivered the within Easement, Restrictive Covenants, Release, and Agreement as of \_\_\_\_\_, 199\_\_.

Signed, Sealed and Delivered  
in the Presence of:

\_\_\_\_\_ (L.S.)  
(Witness)

\_\_\_\_\_  
(Witness)

## *Appendix 7.6.*

### *--North Carolina Acquisition of Open Space Statute 160A-401-407*

#### **NC General Statutes 160A - 401-407**

##### Part 4. Acquisition of Open Space.

##### § 160A-401. Legislative intent.

It is the intent of the General Assembly in enacting this Part to provide a means whereby any county or city may acquire, by purchase, gift, grant, bequest, devise, lease, or otherwise, and through the expenditure of public funds, the fee or any lesser interest or right in real property in order to preserve, through limitation of their future use, open spaces and areas for public use and enjoyment. (1963, c. 1129, s. 1; 1971, c. 698, s. 1.)

##### § 160A-402. Finding of necessity.

The General Assembly finds that the rapid growth and spread of urban development in the State is encroaching upon, or eliminating, many open areas and spaces of varied size and character, including many having significant scenic or esthetic values, which areas and spaces if preserved and maintained in their present open state would constitute important physical, social, esthetic, or economic assets to existing and impending urban development. The General Assembly declares that it is necessary for sound and proper urban development and in the public interest of the people of this State for any county or city to expend or advance public funds for, or to accept by purchase, gift, grant, bequest, devise, lease, or otherwise, the fee or any lesser interest or right in real property so as to acquire, maintain, improve, protect, limit the future use of, or otherwise conserve open spaces and areas within their respective jurisdictions as defined by this Article. The General Assembly declares that the acquisition of interests or rights in real property for the preservation of open spaces and areas constitutes a public purpose for which public funds may be expended or advanced. (1963, c. 1129, s. 2; 1971, c. 698, s. 1.)

##### § 160A-403. Counties or cities authorized to acquire and reconvey real property.

Any county or city in the State may acquire by purchase, gift, grant, bequest, devise, lease, or otherwise, the fee or any lesser interest, development right, easement, covenant, or other contractual right of or to real property within its respective jurisdiction, when it finds that the acquisition is necessary to achieve the purposes of this Part. Any county or city may also acquire the fee to any property for the purpose of conveying or leasing the property back to its original owner or other person under covenants or other contractual arrangements that will limit the future use of the property in accordance with the purposes of this Part, but when this is done, the property may be conveyed back to its original owner but to no other person by private sale. (1963, c. 1129, s. 3; 1971, c. 698, s. 1.)

§ 160A-404. Joint action by governing bodies.

Any county or city may enter into any agreement with any other county or city for the purpose of jointly exercising the authority granted by this Part. (1963, c. 1129, s. 4; 1971, c. 698, s. 1.)

§ 160A-405. Powers of governing bodies.

Any county or city, in order to exercise the authority granted by this Part, may:

- (1) Enter into and carry out contracts with the State or federal government or any agencies thereof under which grants or other assistance are made to the county or city;
- (2) Accept any assistance or funds that may be granted by the State or federal government with or without a contract;
- (3) Agree to and comply with any reasonable conditions imposed upon grants;
- (4) Make expenditures from any funds so granted. (1963, c. 1129, s. 5; 1971, c. 698, s. 1.)

§ 160A-406. Appropriations authorized.

For the purposes set forth in this Part, a county or city may appropriate funds not otherwise limited as to use by law. (1963, c. 1129, s. 6; 1971, c. 698, s. 1; 1973, c. 426, s. 60; 1975, c. 664, s. 14.)

§ 160A-407. Definitions.

(a) For the purpose of this Part an “open space” or “open area” is any space or area (i) characterized by great natural scenic beauty or (ii) whose existing openness, natural condition, or present state of use, if retained, would enhance the present or potential value of abutting or surrounding urban development, or would maintain or enhance the conservation of natural or scenic resources.

(b) For the purposes of this Part “open space” or “open area” and the “public use and enjoyment” of interests or rights in real property shall also include open space land and open space uses. The term “open space land” means any undeveloped or predominantly undeveloped land in an urban area that has value for one or more of the following purposes: (i) park and recreational purposes, (ii) conservation of land and other natural resources, or (iii) historic or scenic purposes. The term “open space uses” means any use of open space land for (i) park and recreational purposes, (ii) conservation of land and other natural resources, or (iii) historic or scenic purposes. (1963, c. 1129, s. 7; 1969, c. 35, s. 1; 1971, c. 698, s. 1.)

# *Appendix 8*

## *8.0 Examples of Developer Agreements*

### *8.1 City of Aurora, Colorado Development Agreement*

### *8.2 Montgomery County, Maryland Site Plan Enforcement Agreement*



## Appendix 8.1

### DEVELOPMENT AGREEMENT

THIS AGREEMENT made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_, by and between \_\_\_\_\_, hereinafter referred to “DEVELOPER,” and the CITY OF \_\_\_\_\_, a municipal corporation of the Counties \_\_\_\_\_, State of \_\_\_\_\_, hereinafter referred to as “CITY.”

#### RECITALS

1. DEVELOPER is the owner of the property described in Exhibit “A,” attached hereto (the “Property”) and has filed a petition to annex said property to the CITY; and

2. The parties mutually agree pursuant to City Code Section 146-301 that the annexation of the Property to the CITY shall not create any additional cost or impose additional burden on the existing residents of the CITY to provide public facilities and services to the Property after annexation. If the proposed development will result in new burdens on the city’s existing public facilities and services, the development shall be responsible for mitigating such impacts through compliance with standards adopted by the city council. The standards will include fees calculated and imposed to provide adequate public facilities and services based on objective criteria.

A. Developer desires to develop the Property as a master planned residential golf club community zoned and entitled for 1,500 single family residential units, together with open space, recreational amenities and other related uses, and consisting of two distinctive lifestyle communities as generally described below (the “Project”):

(1) A golf-oriented residential community organized around an exclusive, private golf club, and consisting of a PGA/TPC (Professional Golf Association/Tournament Players Club) or equivalent championship caliber golf course designed by a “signature” golf course architect, together with a clubhouse and related amenities commensurate with PGA/TPC standards; and a lake-oriented residential community organized around an approximately 35-acre lake and associated swim, tennis and similar recreational facilities.

In consideration of the foregoing premises and the covenants, promises, and agreements of each of the parties hereto, to be kept and performed by each of them IT IS AGREED:

#### 1. DEFINITIONS

1.1 “Developer” shall mean and refer to the DEVELOPER, and his heirs, successors, assigns, and designees.

1.2 “Crossings” shall mean and refer to all bridges, culverts, or other types of facilities or structures used to cross roadways, drainage ways, or storm drainage areas.

1.3 “Drainage Basin Development Fee” shall mean the CITY’s fee of \$1,052 per gross acre, or as such amount may be subsequently adjusted by City Council, payable at the time of subdivision platting, which is levied and assessed upon each vacant and undeveloped lot and parcel of land within the CITY for the purpose of funding the construction and installation of major facilities in accordance with the Drainage Master Plan.

1.4 “Off-Site Traffic Impact Fee” shall mean the CITY’s fee of \$500 per gross acre, or as such amount may be subsequently adjusted by City Council, payable at the time of subdivision platting, which the CITY normally charges to offset the costs to the CITY of improvements to streets beyond the limits of the property, which are required to address the impacts to such streets from development on the property.

1.5 “Park Development Fee” shall mean the CITY’s fee established by City Council, or as such amount may subsequently be adjusted by City Council, payable at the time building permit issuance, which the CITY charges to offset the costs to the CITY of improvements to public park lands that are required to address the impacts to such parks from development on the property.

1.6 “Sewer Interceptor Fee” shall mean the CITY’s fee of \$500 per gross acre, or as such amount may be subsequently adjusted by the City Council, payable at the time of subdivision platting, which the CITY charges for extension by the CITY of sewer interceptor lines and other improvements necessary to provide sanitary sewer service to development on the property.

1.7 “Sewer Interceptor Lines” shall mean and refer to sewer lines larger than twelve inches (12”) in diameter.

1.8 “Siren Fee” shall mean the CITY’s fee of \$78 per gross acre, or as such amount may be subsequently adjusted by the City Council, payable at the time of subdivision platting, which the CITY charges for providing public safety warning sirens to serve the property.

1.9 “Streets” shall mean and refer to residential, commercial, collector, minor, and principal arterial streets, highways, expressways, and roadways.

1.10 “Urban Services Extension Fee” shall mean the CITY fee of \$131.64 per dwelling unit per year, \$.15 per year per square foot for gross floor area for office, commercial, and retail, and \$.11 for industrial buildings, or as such amounts may be subsequently adjusted by City Council, payable on a monthly basis by the property owner after issuance of certificate of occupancy, which the CITY charges for the provision of municipal services other than water transmission and sewer interceptor service for lands that are located beyond the urban service area as established by the City Council.

1.11 “Water Transmission Development Fee” shall mean the CITY’s fee of \$1,100 per acre, or as such amount may be subsequently adjusted by City Council, payable at the

time of subdivision platting, which the CITY charges for extension by the CITY of water transmission lines to supply water to the property.

1.12 “Water Transmission Lines” shall mean and refer to water lines larger than twelve inches (12”) in diameter.

## 2. STREETS

2.1 DEVELOPER shall dedicate free and clear of all liens and encumbrances of any kind, all rights-of-way for public streets for the full width thereof, as required by the CITY. DEVELOPER shall design and fully improve to CITY standards all public streets within the Property, and one-half of all streets lying on or abutting the exterior boundaries of the Property, without cost to CITY. Such dedication of streets shall occur at the time of CITY approval of each subdivision plat within the Property; however, DEVELOPER agrees to dedicate such rights-of-way at an earlier time when determined by CITY to be required for commencement of construction of such streets or for extension of utilities. An earlier dedication shall not relieve DEVELOPER of his obligation to improve streets as provided herein.

2.2 DEVELOPER agrees to convey to CITY an easement in gross adjoining arterials, highways, and expressways to provide necessary cut and fill to establish the grade on a one foot incline for every three feet (3’) of distance. Said easement shall be released to DEVELOPER at such time as the adjacent property is filled and maintained at grade.

2.3 DEVELOPER shall pay a per acre off-site traffic impact fee as established by ordinance for the acreage within the Property for the improvement of off-site transportation facilities. Such fee shall be due and payable pro rata based upon the acreage of each plat at the time of CITY approval of each subdivision plat within the Property. DEVELOPER agrees to include the Property in districts or other mechanisms established by CITY for improvement of roadways.

2.4 DEVELOPER will advance the funds required for signalization of perimeter streets when needs meet the required warrants as reasonably determined by CITY, subject to reimbursement on an equitable pro rata basis by other landowners contributing to the warranting of such signals, such reimbursement to be administered by CITY by separate agreement between DEVELOPER and CITY pursuant to the city code.

## 3. WATER AND SEWER

3.1 The CITY agrees to install water transmission lines and sewer interceptor lines to the Property at a point nearest CITY’S existing facilities, in accordance with its master plan. DEVELOPER agrees to dedicate all necessary unobstructed right-of-way for utility easements needed for water and sewer lines to serve the area described herein, or for transmission through the area described herein, not less than sixteen feet (16’) in width for a sanitary sewer or water line, and not less than twenty-six feet (26’) in width when a parallel water and sewer line must be installed. The DEVELOPER shall grant additional temporary construction easements for installation of water and sewer

mains where required by the CITY. DEVELOPER agrees to develop and provide to the CITY for review and approval prior to platting of the Property a master utilities plan for the annexed area. The master utilities plan shall describe transmission facilities and distribution facilities.

3.2 Subject to Section 3.3 herein, the CITY shall provide water and sewer service to the Property within a reasonable period of time after notification of need by the DEVELOPER as required for development of the Property. DEVELOPER agrees to pay to CITY a per acre water transmission development fee and a per acre sewer interceptor fee as established by ordinance for the gross acreage within the Property. The water transmission development fee and sewer interceptor fee shall be due and payable pro rata based upon the acreage of each plat at the time of CITY approval of each subdivision plat within the Property. The fee amount shall be that in effect at the time of payment. DEVELOPER further agrees to make additional payments on the balance of the water transmission development fee and sewer interceptor fee as may be required from time to time to extend water transmission and sewer interceptor lines to serve the Property as needed for development. In the event, however, that the total amount of such fees is insufficient to fund extension of the line, DEVELOPER shall advance the necessary funds to pay for the total cost to design and construct extension of water transmission and sewer interceptor line extensions. DEVELOPER may proceed under a separate agreement with CITY for payback of costs in excess of fees from pursuant to Section 8.1.

3.3 There shall be no duty or obligation upon the CITY to furnish water or sanitary sewer facilities to the area sought to be annexed until such time as, in the sole discretion of CITY, sufficient acreage has been annexed and fees paid to pay for extension of water and sewer facilities and to provide services to a sufficient number of inhabitants within the areas so as to make the construction and establishment of such services feasible. The City's obligation to provide water is subject to any water restrictions and rate modifications that the City Council enacts under its general police power.

3.4 Notwithstanding the fees provided in this Article III, if provisions of water and sewer services requires payment of fees or charges to regional or metropolitan service agencies or other third party authorities, DEVELOPER shall provide such funds as and when required by such service agency.

3.5 DEVELOPER will pay tap fees as are required by the CITY at the time said taps are needed. The DEVELOPER agrees that all promises of water and sanitary sewer service made by this agreement are subject to any water and sewer tap allocation program of the CITY, and are uniformly applied subject to any other general restrictions of the CITY, or regional service agencies, relating to the provision of water and sanitary sewer service.

3.6 Prior to final approval of the annexation ordinance, DEVELOPER shall deliver to CITY a special warranty deed for the non-tributary and not non-tributary water within the Dawson-Arkose, Denver, Arapahoe, and Laramie-Fox Hills aquifers that lie beneath the DEVELOPER'S Property. In addition to standard warranties of a deed of this type, the special warranty deed shall specifically warrant that the grantor has not divested

himself of the subject non-tributary and not non-tributary groundwater prior to its conveyance to the CITY.

3.7 The DEVELOPER grants in perpetuity to the CITY the sole and exclusive right to withdraw, appropriate, and use any and all water within the Dawson-Arkose, Denver, Arapahoe, and Laramie-Fox Hills aquifers underlying the Property. The DEVELOPER irrevocably consents in perpetuity, on behalf of itself and any and all successors in title, pursuant to Section 37-90-137(4) of the Colorado Revised Statutes, as now existing or later amended, to the withdrawal, appropriation, and use by the CITY of all such water, and agrees to execute any additional or supplemental consents thereto that may be required for the CITY to withdraw, appropriate, or use said water.

3.8 The drilling of water wells upon the Property shall not be commenced or undertaken without the prior approval of the CITY COUNCIL. To the extent that the CITY wishes to drill wells on the Property, the location of such wells shall not affect materially the development plan. The DEVELOPER agrees to convey necessary easements to CITY for wells.

#### 4. STORM DRAINAGE

4.1 DEVELOPER shall pay the per-acre drainage fee established by City Code for basin-wide drainage facilities as required by CITY'S master drainage plan and ordinances. The fee shall be payable at the time of CITY approval of each subdivision plat within the Property. The amount payable shall be pro rata based upon the acreage of each plat

4.2 In the event the DEVELOPER desires to complete the development of any portion of the annexed lands prior to completion of the regional storm drainage improvements to major drainage ways by the CITY, the DEVELOPER may make those improvements at its expense. At its option, and subject to a separate agreement, the CITY may agree to reimburse the DEVELOPER at a future date for DEVELOPER'S cost for construction of said improvements.

4.3 DEVELOPER shall be responsible for design and construction of drainage improvements, other than basin-wide improvements described in Section 4.1, as required by CITY to permit development of the property

4.4 DEVELOPER shall dedicate all land within the 100-year floodplain and a maintenance trail corridor at the time of platting of any property located adjacent to the floodplain.

4.5 DEVELOPER shall petition for annexation to Urban Drainage Flood Control District when platting occurs on any part of the Property (if located east of Powhaton Road).

## 5. CROSSINGS

5.1 The parties mutually agree that whenever it is found and determined by CITY that a crossing of drainage way, existing or proposed roadway, railroad, or any impediment to a roadway is required within the Property, CITY shall specify design criteria, and DEVELOPER shall construct the crossing, including transition improvements, in conjunction with the development of the Property. The crossings required for the described property shall be constructed in conformance with CITY standards.

5.2 If a crossing is required on the exterior boundary of the Property, DEVELOPER shall be responsible for his proportionate share of the construction cost as determined by CITY.

## 6. PUBLIC LAND DEDICATION

6.1 DEVELOPER agrees to dedicate land to CITY to be used for public purposes, or pay cash in lieu of land if required by CITY. Dedication of land or payment of cash shall occur at the time of approval of the first subdivision plat for development within the Property. Land dedication for parks shall comply with the requirements of the City Code. Land dedicated for public uses other than parks shall equal one percent (1%) of residentially zoned property. In addition, Developer shall also dedicate land for public uses equal to two percent (2%) of the Property zoned nonresidential. All dedicated lands shall be platted by DEVELOPER at the time of dedication in accordance with the CITY's subdivision regulations. The external boundaries of the dedicated land shall be monumented on the ground as required by the City Code.

6.2 In the event CITY requires cash in lieu of land dedication, DEVELOPER shall pay money to the CITY in an amount equal to the fair market value at the time of payment of improved land as described in Section 6.3 herein. shall meet all the standards for acceptance by the CITY as enumerated herein. The full in-lieu payment shall be due, if not sooner paid, prior to the expiration date of this agreement. All such dedicated or conveyed real property shall be dedicated for the perpetual use and benefit of the public by the dedication language of the relevant subdivision plat or shall be conveyed to the CITY by general warranty deed free and clear of mortgages, deeds of trust, and other liens of whatever sort, and be free and clear of other restrictions, reservations, exceptions, covenants, easements, rights-of-way, and other encumbrances (except easements of record), and other encumbrances or natural conditions, except for those to which CITY had no reasonable objection in light of the intended use of the site, at no monetary cost to the CITY. Said land shall have zoning to permit the intended use.

6.3 Promptly upon applying for any subdivision plat, the approval of which will trigger any in-lieu payment, DEVELOPER shall notify CITY and commence negotiations to agree upon the amount of said in-lieu payment. If the parties cannot agree upon the amount of any in-lieu payment required by this agreement, each party shall appoint an appraiser of its choosing, whose fees shall be paid by the appointing party. If the two appraisers thus appointed cannot agree on the amount, they shall jointly appoint a third appraiser whose fees shall be paid half by DEVELOPER and half by the CITY. The

amount shall be the average of the two appraisal amounts (out of three appraisals) which are closest to one another in value. Until the amount is established as provided in this Section, CITY shall not approve the plat that triggers the payment at issue to proceed to final approval. CITY agrees to respond with reasonable promptness in all matters regarding determination under this Section so as to minimize the platting delay, if any, to DEVELOPER.

6.4 DEVELOPER agrees that if between the time of annexation and subdividing, any of the described Property is rezoned from a nonresidential to a residential classification, or a residential zoned area is rezoned to a higher density, the CITY may require additional land dedications at the time of subdivision platting.

6.5 To the extent the described Property is to be zoned residential, DEVELOPER shall dedicate land for public schools as required by the city code. All land or cash in lieu shall be due at the time of the platting of the first residential subdivision. Land dedicated for schools shall comply with the requirements of City Code Section 147-48.

6.6 The DEVELOPER agrees that lands to be donated for public purposes shall include all site and public improvements including, but not limited to water, sewer, curb, gutter, streets, and sidewalks. DEVELOPER shall install such improvements when determined by the CITY to be necessary. (Or, if determined by the CITY at the time of conveyance that the improvements are not needed at that time, then DEVELOPER shall enter into a separate agreement specifying when and how the improvements will be made). No lands to be dedicated for public purposes shall be disturbed by DEVELOPER in any manner to disrupt the natural landscape, unless first approved by the CITY. DEVELOPER agrees that all lands donated to the CITY shall not be used as a borrow or fill area. Any sites dedicated for public purposes, but disturbed due to grading of adjacent sites, or lands within the flood plain disturbed due to storm drainage improvements, must be successfully planted or seeded by DEVELOPER with native grasses acceptable to CITY to prevent erosion.

6.7 DEVELOPER hereby grants to CITY a lien on the Property to secure payment of the amounts or dedications of the lands and water rights. This lien may be foreclosed like a mortgage, but only after written demand for payment or dedication to the owner(s) of the land to be foreclosed upon followed by sixty (60) days without payment or dedication of all amounts or lands identified in said demand.

6.8 DEVELOPER agrees to pay to CITY a park development fee as required by the City Code, as such amount may be subsequently adjusted by the City Council

## 7. URBAN SERVICES

7.1 If the proposed development will result in new burdens on the city's existing public facilities and services, the development shall be responsible for mitigating such impacts through compliance with standards adopted by the city council. The standards will include fees calculated and imposed to provide adequate public facilities and services based on objective criteria

7.2 DEVELOPER acknowledges that the Property is located beyond the area of existing CITY services. The CITY will extend services to the Property in an orderly manner as provided by CITY'S urban service extension ordinance. In the event the Property develops prior to the date of extension, DEVELOPER agrees to pay the urban services extension fee as established by ordinance upon the granting of certificate of occupancy for structures on the Property. DEVELOPER shall continue to pay said fee until the CITY'S urban service area is extended to include the Property, at which time the obligation to pay the fee shall terminate.

7.2 It is expressly understood that the CITY may be unable to provide fire protection to any of the annexed land prior to the installation of required fire hydrants. DEVELOPER shall petition for exclusion from the fire protection district upon completion of the annexation and approval of zoning. In any event, the exclusion shall be completed before the first residential building permit is issued. CITY shall provide fire protection upon exclusion of the Property from the district.

7.3 If the area of the herein described annexation lies wholly or partially within a legally constituted water, sanitation, or water and sanitation district, there shall be no obligation on the part of the CITY to provide such utilities services to the areas within any such district, unless it be done by mutual agreement between the CITY and such district. However, if requested by the CITY, the DEVELOPER shall petition for exclusion from the district. In the event of exclusion, the CITY shall assume responsibility for service to the annexed area, and the DEVELOPER shall comply with all applicable utilities service provisions contained herein.

7.4 DEVELOPER shall pay a fee of \$78.00 per acre, as such amount may be subsequently adjusted by the City Council, at the time of subdivision plat approval to be used by the City to fund emergency warning siren in the area. If requested by CITY, DEVELOPER shall provide a minimum of ten (10) foot by ten (10) foot easement to locate the siren and tower.

## 8. PUBLIC FACILITY EXTENSION

8.1 Extension of water and sewer line, streets, storm drainage, street lighting, traffic control devices, and other public improvements from the developed areas of the CITY to the Property may be pursuant to reimbursement as provided in the City Code to reimburse DEVELOPER from lands abutting such facilities for DEVELOPER'S costs to extend public facilities which benefit such intervening lands.

## 9. DEVELOPMENT; PERMITTED USES/DESIGN STANDARDS.

9.1 The development parcel sizes and locations, roadway locations and other aspects of the Project will be finally determined during the City's review and approval of subdivision plats, Framework Development Plan(s), and Contextual Site Plan(s) in accordance with the procedures established in the \_\_\_\_\_ Regulations. However, the uses and number of dwelling units (1,500) within the Project are intended to be vested property rights. During the Term, the City shall not accept for processing any

application for rezoning of any portion of the Property unless such application includes a certificate executed by Developer consenting to the action requested.

9.2 The permitted uses of the Property, the density and intensity of use (including, without limitation, 1,500 dwelling units, together with golf course, club house and other uses), the design standards, provisions for reservation or dedication of land for public purposes, the general location of roads and trails, and other terms and conditions of development applicable to the Property and the Project shall be as set forth in this Agreement. The design, improvement, construction, and development of the Property shall be in substantial conformance with the \_\_\_\_\_ Zone District Regulations. In order to reasonably assure that development of the Project will result in a high-end residential community with home prices in a target range of 130% to 500% of the average price for single family detached homes in the Denver metropolitan market, Developer expects to impose and enforce through private covenants, conditions and restrictions design standards which are more stringent than and supplemental to those set forth in the \_\_\_\_\_ Zone District Regulations. Such privately imposed design standards will be intended to impose among other standards, the following requirements: (i) lot sizes ranging between 6,000 and more than 49,000 square feet; (ii) premium quality semi-custom homes ranging between 2,000 and more than 6,000 square feet of floor area; and (iii) a premium amenity package.

9.3 Additional Standards.

## 9. GENERAL PROVISIONS

9.1 This agreement shall be recorded with the Clerk and Recorder in \_\_\_\_\_ County, \_\_\_\_\_, shall run with the land, and shall be binding upon and inure to the benefit of the heirs, successors, and assigns of the parties hereto. DEVELOPER shall notify CITY of assignments and the names of assignees. Every part of the Property shall at all times remain subject to all the obligations of this agreement with respect to each and every part of the Property.

9.2 In order to facilitate construction of improvements and subject to CITY'S rights of review and approval under the laws of the State of \_\_\_\_\_, and the City Code, CITY will consider the creation of one or more districts including, but not limited to special districts, general improvement districts, and metropolitan districts authorized pursuant to (insert state statute reference)., to provide financing of public improvements. DEVELOPER agrees that any special districts established within the Property shall not levy, charge, or collect a sales tax, nor shall such districts apply for or request Colorado Conservation Trust Funds as supplemented by the state lottery.

9.3 Nothing contained in this agreement shall constitute or be interpreted as a repeal of existing codes or ordinances or as a waiver or abnegation of CITY'S legislative, governmental, or police powers to promote and protect the health, safety, or general welfare of the municipality or its inhabitants; nor shall this agreement prohibit the enactment by CITY of any fee which is of uniform or general application.

9.4 No right or remedy of disconnection of the described Property from the CITY shall accrue from this agreement, other than that provided by City Code Section \_\_\_\_\_. DEVELOPER covenants that the urban service extension fee shall not constitute grounds for disconnection. In the event the Property or any portion thereof is disconnected at DEVELOPER'S request, CITY shall have no obligation to serve the disconnected Property and this agreement shall be void and of no further force and effect as to such Property.

9.5 If the annexation of the Property or any portion thereof is challenged by a referendum, all provisions of this agreement, together with the duties and obligations of each party, shall be suspended pending the outcome of the referendum election. If the referendum challenge to the annexation results in disconnection of the Property from the CITY then this annexation agreement and all provisions contained herein shall be null and void and of no further effect. If the referendum challenge fails, then DEVELOPER and CITY shall continue to be bound by all the terms and provisions of this annexation agreement.

9.6 In the event that the annexation of the Property or any portion thereof is voided by final action of any court, CITY and DEVELOPER shall cooperate to cure the legal defect which resulted in disconnection of the property, and upon such cure this annexation agreement shall be deemed to be an agreement to annex the Property to CITY pursuant to Section 31-12-121 of the Colorado Revised Statutes, 1973, and City Code 138-223 and 138-327. DEVELOPER shall reapply for annexation as when the Property becomes eligible for annexation as determined by CITY.

9.7 It is understood and agreed by the parties hereto that if any part, term, or provision of this agreement is by the courts held to be illegal or in conflict with any law of the State of Colorado, the validity of the remaining portions or provisions shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if the agreement did not contain the particular part, term, or provision held to be invalid.

9.8 All fees recited in this agreement shall be subject to amendment by City Council. Any amendment to fees shall be incorporated into this agreement as if originally set forth herein. Nothing in this agreement shall prevent, prohibit, diminish, or impair the city's home rule governmental authority to adopt fees or regulations to address the impacts of development.

9.9 DEVELOPER agrees to include the Property in public improvement districts as may be organized by the CITY pursuant to the provisions of Title 31, Article 25, Part 6, of the Colorado Revised Statutes.

9.10 This instrument embodies the whole agreement of the parties. There are no promises, terms, conditions, or obligations other than those contained herein; and this agreement shall supersede all previous communications, representations, or agreements, either verbal or written, between the parties hereto. Except as provided in Section 9.8, there shall be no modification of this agreement except in writing, executed with the

same formalities as this instrument. Subject to the conditions precedent herein, this agreement may be enforced in any court of competent jurisdiction.

9.11 This agreement shall terminate and expire upon the completion of the development of the property and satisfaction of all the obligations herein. Thereafter, so long as the Property is located within the municipal boundaries of CITY, it shall continue to be subject to the charter, ordinances, and rules and regulations of the CITY.

9.12 It is expressly understood and agreed that enforcement of the terms and conditions this Agreement, and all rights of action relating to such enforcement, shall be strictly reserved to the Parties hereto, their successors and assigns, and nothing contained in this Agreement shall give or allow any claim or right of action by any other or third person under this Agreement. It is the express intention of the Parties that any person other than the Parties receiving services or benefits under this Agreement shall be deemed to be an incidental beneficiary only.

9.13 Any and all obligations of the CITY for water, sewer, and drainage improvements shall be the sole obligation of the CITY’S Utility Enterprise and as such, shall not constitute a multiple fiscal year direct or indirect debt or other financial obligation of the CITY within the meaning of any constitutional, statutory, or charter limitation. Any and all obligations of the CITY for public improvements other than water, sewer, and storm drainage improvements shall be subject to annual appropriation by the City Council.

9.14 In the event of breach or default by the city, the sole remedies hereunder shall be the equitable remedies of specific performance or injunction. Developer, it successors and assigns, hereby waive any rights to money damages for any such breach or default.

IN WITNESS WHEREOF, the parties hereto have executed this agreement the day and year first above written.

By \_\_\_\_\_  
DEVELOPER

State of \_\_\_\_\_  
County of \_\_\_\_\_

Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, 200\_, by \_\_\_\_\_  
\_\_\_\_\_.

My commission expires:

\_\_\_\_\_

\_\_\_\_\_  
Notary Public

CITY OF \_\_\_\_\_

By \_\_\_\_\_  
\_\_\_\_\_, Mayor

ATTEST:

\_\_\_\_\_  
City Clerk

APPROVED AS TO FORM:

\_\_\_\_\_  
City Attorney's Office

Development agreement draft

*Appendix 8.2*

\_\_\_\_\_  
(County)

**SITE PLAN ENFORCEMENT AGREEMENT**

This Agreement by and between \_\_\_\_\_ (Applicant), and the COUNTY Planning Board of The (Planning Board), is effective the date signed by the Planning Board.

WHEREAS, § 59-D-3.3 of the COUNTY Code (Code) requires the Applicant, as part of the site plan review process, to enter into a formal agreement with the Planning Board; and

WHEREAS, the Code requires the Applicant to agree to execute all features of the approved site plan noted in § 59-D-3.23 in accordance with the development program required by § 59-D-3.23(m).

NOW THEREFORE, in consideration of the mutual promises and stipulations set forth herein and pursuant to the requirements of § 59-D-3.3 of the Code, the parties hereto agree as follows:

1. The Applicant agrees to comply with all of the conditions set forth in the Planning Board’s Opinion and to execute all of the features of approved Site Plan No. 8 (Site Plan), including all features noted in § 59-D-3.23, in accordance with the approved Development Program required by § 59-D-3.23(m), attached and incorporated herein by reference.

2. This Agreement is binding on the Applicant, its successors and assigns, and on the land and improvements in perpetuity or until released in writing by the Planning Board.

IN WITNESS WHEREOF, the parties hereto have set our hands and seals as of the date and year set forth below.

\_\_\_\_\_  
(COUNTY)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Applicant



## *Appendix 9*

### *9.0 Applicable Planning and Zoning Ordinances from Local Jurisdictions*

#### *9.1 Adequate Public Facilities Ordinance*

*Montgomery County, Maryland*

*Montgomery County Code, Chapter 60 November 1977*

#### *9.2 Sample Height Ordinance:*

*An Ordinance Regulating the Height of Structures  
and Other Activities in the Vicinity of Fort Campbell,  
Kentucky, and Providing Penalties for Violation*

## *Appendix 9.1*

**SAMPLE ADEQUATE PUBLIC FACILITIES ORDINANCE  
MONTGOMERY COUNTY, MARYLAND**

§50-35

MONTGOMERY COUNTY CODE

Chapter 50

\* \* \* \* \*

- (k) *Adequate public facilities.* A preliminary plan of subdivision must not be approved unless the Planning Board determines that public facilities will be adequate to support and service the area of the proposed subdivision. Public facilities and services to be examined for adequacy will include roads and public transportation facilities, sewerage and water service, schools, police stations, firehouses, and health clinics.
- (1) Periodically the District Council will establish by resolution, after public hearing, guidelines for the determination of the adequacy of public facilities and services. An annual growth policy approved by the County Council may serve this purpose if it contains those guidelines. To provide the basis for the guidelines, the Planning Board and the County Executive must provide information and recommendations to the Council as follows:
- a. The Planning Board must prepare an analysis of current growth and the amount of additional growth that can be accommodated by future public facilities and services. The Planning Board must also recommend any changes in preliminary plan approval criteria it finds appropriate in the light of its experience in administering these regulations.
  - b. The County Executive must comment on the analyses and recommendations of the Planning Board and must recommend criteria for the determination of the adequacy of public facilities as the executive deems appropriate.
- (2) The applicant for a preliminary plan of subdivision must, at the request of the Planning Board, submit sufficient information and data on the proposed subdivision to demonstrate the expected impact on and use of public facilities and services by possible uses of said subdivision.
- (3) The Planning Board must submit the preliminary plan of subdivision to the County Executive in addition to the agencies specified in Section 50-35(a).
- (4) The Planning Board must consider the recommendations of the County Executive and other agencies in determining the adequacy of public facilities and services in

accordance with the guidelines and limitations established by the County Council in its annual growth policy or established by resolution of the District Council after public hearing.

- (5) Until such time as the annual growth policy or resolution of the District Council provides guidelines and limitations for the determination of the adequacy of public facilities and services, public facilities may be determined to be adequate to service a tract of land or an affected area when the following conditions are found to exist:
- a. The tract or area will be adequately served by roads and public transportation facilities. The area or tract to be subdivided shall be deemed adequately served by roads and public transportation facilities if, after taking into account traffic generated by all approved subdivisions and the subject subdivision, the following conditions will be satisfied:
    - (i) For the geographic area in which the proposed subdivision is located, an acceptable average peak-hour level of service will result from:
      1. Existing publicly maintained all-weather roads;
      2. Additional roads programmed in the current adopted capital improvements program of the County or the Maryland consolidated transportation program, for which one hundred (100) percent of the expenditures for construction are estimated to occur in the first four (4) years of the program; and
      3. Available or programmed public bus, rail, or other public or private form of mass transportation.
    - (ii) For intersections or links significantly affected by traffic from the subject subdivision, an acceptable peak hour level of service will result from:
      1. Existing publicly maintained all-weather roads;
      2. Additional roads identified on the approved road program published by the County Executive; and
      3. Available or programmed public bus, rail, or other form of mass transportation.
    - (iii) For the purposes of subsection (ii) above, the County Executive shall publish periodically an approved road program which shall list all roads programmed in the current adopted capital improvements program and the Maryland consolidated transportation program for which:
      1. In the case of the capital improvements program, one hundred (100) percent of the funds have been appropriated for construction costs; and

2. The County Executive has determined that construction will begin within two (2) years of the effective date of the approved road program.
- (iv) For the purposes of subsections (i) and (iii) above, roads required under Section 302 of the Charter to be authorized by law are not considered programmed until they are finally approved in accordance with Section 20-1 of this Code.
  - (v) Any parcel zoned for light industrial use (I-I) which has been in reservation for public use pursuant to action of the Montgomery County Planning Board at any time since June 1, 1981, and which has not changed in size or shape since June 1, 1958, will not be subject to the above subsection (a) if a preliminary plan was submitted prior to June 1, 1981.
- b. The tract or area has adequate sewerage and water service.
    - (i) For a subdivision dependent upon public sewerage and water systems:
      1. Said area or tract to be subdivided shall be deemed to have adequate sewerage and water service if located within an area in which water and sewer service is presently available, under construction, or designated by the County Council for extension of water and sewer service within the first 2 years of a current approved 10-year water and sewerage plan.
      2. If the area or tract to be subdivided is not situated within an area designated for service within the first 2 years of a current approved 10-year water and sewerage plan, but is within the last 8 years of such plan, it is deemed to have adequate water and sewerage service if the applicant provides community sewerage and/or water systems as set forth in Subtitle 5 of Title 9 of Article Health-Environmental of the Annotated Code of Maryland provided the installation of such facilities has been approved by the State Department of Health and Mental Hygiene, the Washington Suburban Sanitary Commission, the Health and Human Services Department, and the Montgomery County Council.
    - (ii) For a subdivision dependent upon the use of septic systems: Said area or tract to be subdivided shall be deemed to have adequate sewerage service if development with the use of septic systems is in accordance with Section 50-27, or regulations published by the Maryland State Department of Health and Mental Hygiene pursuant to Article Health-Environmental, Annotated Code of Maryland, whichever imposes the greater or more stringent requirement.
    - (iii) In its determination of the adequacy of sewerage or water service, the Planning Board shall consider the recommendation of the Washington

Suburban Sanitary Commission, the capacity of trunk lines and sewerage treatment facilities and any other information presented.

- c. The tract or area is so situated as not to involve danger or injury to health, safety or general welfare. Such danger or injury may be deemed not to exist:
    - (i) When physical facilities, such as police stations, firehouses and health clinics, in the service area for the preliminary subdivision plan are currently adequate or are scheduled in an adopted capital improvements program in accordance with the applicable area master plan or general plan to provide adequate and timely service to the subdivision; and
    - (ii) If adequate public utility services will be available to serve the proposed subdivision; and
    - (iii) When, in the case of schools, the capacity and service areas are found to be adequate according to a methodology set forth in a resolution adopted by the District Council after public hearing; provided, however., that until such resolution by the District Council takes effect, the Planning Board shall determine the adequacy of school facilities after considering the recommendations of the Superintendent of Schools.
  - d. Existing or proposed street access within the tract or area is adequate. Street access may be deemed adequate if the streets:
    - (i) Are adequate to serve or accommodate emergency vehicles,
    - (ii) Will permit the installation of public utilities and other public services,
    - (iii) Are not detrimental and would not result in the inability to develop adjacent lands in conformity with sound planning practices, and
    - (iv) Will not cause existing street patterns to be fragmented.
- (6) For a proposed subdivision located in a Transportation Management District designated under Chapter 42A, Article II, if the Planning Board determines, under criteria and standards adopted by the County Council, that additional transportation facilities or traffic alleviation measures are necessary to ensure that public transportation facilities will be adequate to serve the proposed subdivision, the subdivision plan may not be approved unless approval is subject to the execution of a traffic mitigation agreement.
- (7) Exemptions. Places of worship and residences for staff, parish halls, and additions to schools associated with places of worship, which are on an unrecorded parcel which has not changed in size or shape since June 1, 1958, are not subject to the provisions of section 50-35(k), "Adequate Public Facilities."

- (l) *Relation to Master Plan.* In determining the acceptability of the preliminary plan submitted under the provisions of this Chapter, the Planning Board must consider the applicable master plan, sector plan, or an urban renewal plan approved in accordance with the provisions of Chapter 56. A preliminary plan must substantially conform to the applicable master plan, sector plan, or urban renewal plan, including maps and text, unless the Planning Board finds that events have occurred to render the relevant master plan, sector plan, or urban renewal plan recommendation no longer appropriate.
- (m) Where a Division 59-D-3 site plan is required, in addition to the requirements of this Chapter, the preliminary plan of subdivision must specify that no clearing or grading can occur prior to approval of the Site plan unless otherwise specified in the approval of the preliminary plan of subdivision.
- (n) In approving a preliminary plan or site plan, the Planning Board may, with the concurrence of the Department of Public Works and Transportation and the Department of Permitting Services, require construction by a developer of a reasonable amount of off-site sidewalks or sidewalk improvements. Off-site sidewalks or sidewalk improvements may be required to provide for one or more necessary connections from the proposed development to an existing sidewalk, existing or proposed bus or other.



## *Appendix 9.2*

### **SAMPLE HEIGHT RESTRICTION ORDINANCE**

#### **AN ORDINANCE REGULATING THE HEIGHT OF STRUCTURES AND OTHER ACTIVITIES IN THE VICINITY OF FORT CAMPBELL, KENTUCKY AND PROVIDING PENALTIES FOR VIOLATION**

BE IT ORDAINED by the County Council of Christian County, Ky. in Council Duly Assembled:

##### Section 1

By virtue of the authority granted to Christian County, this Ordinance is enacted to restrict the height of buildings, towers, or other man-made structures, and hazards to aircraft above a certain maximum height, to be hereinafter specified, and to restrict the use of land in any manner which will create electrical interference with radio communications between the aircraft and the base, or otherwise endangering the landing, taking off, or maneuvering of the aircraft using the base or its related activities.

##### Section 2

As used in this Ordinance, unless otherwise stated, the following definitions will be used:

- (1) Airport - Campbell Army Airfield (CAAF), a United States Army Airfield located in Christian County, engaged in aerial operations.
- (2) Airport Elevation - The highest point of CAAF usable land area measured in feet above mean seal level. This elevation is 573 feet MSL.
- (3) Height - For the purpose of determination, the height limits in all zones set forth in this Ordinance will be the height measured in feet above the airport elevation
- (4) Inner Horizontal Surface (marked as Area A on Exhibit #1): An oval-shaped plane 150 feet above the established airfield elevation. It is constructed by scribing an arc with a radius of 7,500 feet about the centerline at each end of each runway and interconnecting these arcs with tangents.
- (5) Conical Surface (marked as Area B on Exhibit #1): An inclined plane that extends from the periphery of the inner horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation.
- (6) Outer Horizontal Surface (marked as Area C on Exhibit #1): A plane located 500 feet above the established airfield elevation, extending outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet, less any portions thereof that extend outside of the unincorporated area of Christian County.

### Section 3

In order to carry out the provisions of this Ordinance, there are hereby created and established certain zones as more fully shown and described in the maps which are attached hereto as exhibit #1, and incorporated by reference in this Act as if stated verbatim.

- A. Exhibit #1 consists of an area located to the south of the City of Hopkinsville and further shown by certain contours encircling CAAF in an oval pattern, lying in a northeastward-southwestern orientation aligned with the principle runway of CAAF.
- C. Areas A and B are the areas affected by this Ordinance. Property owners or land users should consult both the text of this Ordinance and the exhibits to determine locations of properties and the limitations imposed thereon by this Ordinance. In the areas that the two exhibits overlap or conflict, the more stringent limitation or requirement shall govern and prevail.

### Section 4

Except as otherwise provided in this Ordinance, no buildings, tower, or other man-made structure shall be erected or built in any zone created by this Ordinance at a height in excess of the applicable height limit herein established for such zone. Such applicable height limitations are hereby established for each of the zones in question as follows:

- A: The Inner Horizontal Surface (A) - One hundred and fifty feet above the air base elevation or height of 723 feet above mean sea level.
- B. The Conical Surface (B) - This surface is an inclined plan beginning at the inner horizontal surface, 150 feet, and moving upward and outward at a slope of 20 to 1 to a maximum height of 500 feet. No structure shall exceed this height limitation as set forth above, that is to say, between 150 and 500 feet depending on the location of the property in relationship to the inclined zone.
- C. The Outer Horizontal Surface (C) - Five hundred feet above the air base elevation or a height of 1073 feet above mean sea level.

### Section 5

Except as otherwise provided in this Ordinance, no use may be made of the land contained in the contours of Exhibit #1 including the outermost zones which will create electrical interference with radio communications between aircraft and the base, confuse or impair visibility or otherwise endanger the landing, taking off or maneuvering in any manner of aircraft using the base and its related gunnery and bombing range.

### Section 6

The regulations prescribed by this Ordinance shall not be construed to require the removal, lowering or changes in any existing building, tower or structure as of the effective date of this Ordinance. Further, should any existing tower, building or structure require maintenance or replacement, not to exceed its original height and dimensions nothing in this Act will prevent such maintenance or replacement. No

future use of the land and no future construction of any structure shall be allowed which is inconsistent with this Ordinance.

#### Section 7

It shall be the duty of the Zoning Administrator to administer and enforce this Ordinance in the same manner as other building and zoning ordinances or regulated and enforced in Christian County.

#### Section 8

It shall be unlawful for any person to violate these rules and regulations and any person violating them shall, upon conviction, be fined not exceeding one hundred dollars or imprisoned for not more than thirty days. Each day of the violation shall constitute a separate offense.

#### Section 9

If any of the provisions of this Ordinance or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of the Ordinance which can be given effect without the invalid provision or application, and this end the provisions of this Ordinance are declared to be severable.

#### Section 10

This Ordinance shall be in full force and effect from any after its adoption by the Christian County Council.



# *Appendix 10*

## *Sample Noise Reduction Standards for Residential Construction*

Source: “Eastern Carolina Joint Land Use Study, Prepared for Craven County, Carter County, City of Havelock, Town of Emerald Isle, Town of Bogue, Town of Atlantic, and MCAS Cherry Point by the Eastern Carolina Council, Region P Council of Governments; November 2002.



## *Appendix 10*

### **SOUND INSULATION IN RESIDENTIAL STRUCTURES**

#### **DEFINITION**

Sound insulation refers to the use of acoustical related building materials for the reduction of noise for architectural abatement purposes. These materials apply to any areas of a structure that may be part of a sound transmission path including windows, doors, roof systems, ventilation, wall systems (exterior), and utility access points through a building envelope.

#### **CHARACTERISTICS**

The application of sound insulation techniques can involve existing and/or planned structures or buildings. Often the benefits for noise control, such as double pane windows have additional benefits in terms of energy conservation and reduced heat loss. The primary objective of an airport sound insulation program is to reduce the sound transmission through the building envelope (e.g., exterior wall, window, and roof system), thereby having lower interior noise levels. The implementation of such a program may be the adoption of a building code or performance requirements established by a public agency.

#### **POSITIVE FEATURES**

The primary benefit of a sound insulation program is to protect the noise receiver, while they are indoors. Frequently, there are associated benefits of energy conservation when there is building insulation. Such efforts have the flexibility of applying to both existing structures, as well as buildings that will be constructed. Therefore, it can be more comprehensive than a building code. Since building codes generally are applicable only to planned or new structures.

#### **NEGATIVE FEATURES**

Sound insulation controls apply directly to a structure. Therefore it does not improve the outdoor environments, when the individual is outside the home. Often times, sound insulation is considered for selected areas or buildings, rather than being a comprehensive approach.

#### **LEGAL STANDING**

Sound insulation programs are frequently mandates for certain geographical areas as a policy of a jurisdiction with matching federal and local funds involved. Since a program is adopted by a jurisdiction it does represent legal standing.

## SOUND ATTENUATION DEFINITIONS

### DNL Day - Night Sound Level:

An average of the cumulative measure of the noise exposure during a 24-hour day.

### Exterior Wall Rating:

EWR is a single-number rating for exterior building elements (such as walls, windows, doors, etc.) and represents the effective sound transmission loss capability, in decibels, of each element. It differs from the STC rating in that it is based on aircraft noise rather than office noise spectra. For this reason, EWR is superior to STC for describing the sound-insulating properties of exterior wall elements exposed to aircraft noise. The EWR concept was developed by Wylie Laboratories and has been used extensively in studies of residential sound insulation. It is conceptually similar to the STC rating method. Like TL and SIC, the higher the EWR value, the better the noise reduction.

### Noise Reduction:

The quantitative measure of sound isolation between spaces is called Noise Reduction (NR). The NR between two spaces, such as from the exterior to the interior of a dwelling, depends on the TL of the various components in the separating wall, the area of the separating wall, and the acoustical absorption in the receiving room. This value takes more into account than just the sound transmission characteristics of the wall material. Generally, values of NR are determined in one-third octave bands. A higher NR gives a lower noise level in the receiving room, indicating greater noise insulation.

### Noise Level Reduction:

NLR is used to describe the reduction of environmental noise sources, such as aircraft. It is a single-number metric based on values of A-weighted noise reduction (NR). The greater the sound insulation in a wall, the lower the noise level in the receiving room, giving a higher NLR. The NLR is useful because it is a simpler metric to use than NR; one number is easier to apply than a set of numbers in one-third octave bands. However some building materials and components are more effective at reducing low-frequency noise than other materials or components. Since aircraft noise contains a lot of low frequency sound, it is important to ensure that insulating materials and components perform well at low frequencies. NLR is a good indicator of overall wall performance but may not be appropriate when designing modifications for aircraft noise reduction, especially if a good NLR value disguises poor low frequency insulation.

### Sound Transmission Class:

Since working with a series of one-third octave TL measurements can be cumbersome, a single number descriptor based on the one-third octave values has been developed. This rating method is called the Sound Transmission Class (STC). Like TL, the higher the STC rating for a construction method or component, the higher the sound insulation. Originally,

STC ratings were developed as a single-number descriptor for the TL of interior office walls for typical office noise and speech spectra. Now, they are used, often incorrectly, for exterior walls as well. Most acoustical materials and components are commonly specified in terms of their STC ratings.

#### Sound Transmission Loss:

This is the physical measure, which describes the sound insulation value of a built construction system or component. It is a measure, on a logarithmic scale, of the ratio of the acoustic sound power incident on the tested piece to the acoustic sound power transmitted through it. The TL is expressed in decibels (dB). Generally, TL is measured as a function of frequency in one-third octave frequency bands. The higher the sound insulation, the less sound will be transmitted, resulting in a higher TL value. Values of TL are determined in acoustical laboratories under controlled testing methods prescribed by the American Society of Testing and Materials (ASTM).

### SOUND INSULATION OBJECTIVES

The goal for residential sound insulation is to reduce the dwelling interior noise levels due to aircraft operations. Total “soundproofing” of the dwelling, such that aircraft operations are inaudible, is economically infeasible. Modest improvements over the existing characteristics (i.e. less than 5 dB) may not provide a noticeable improvement for the homeowner and hence are not cost effective. The ideal solution is to provide sound insulation, which lies between these two extremes.

#### Interior Noise Objectives:

The DNL is the best predictor of overall long-term community reaction to noise from aircraft as well as other activities. Exterior noise exposure less than DNL 65 dB is normally considered compatible with residential land use. Noise exposure is normally incompatible above 65 dB unless stated noise reductions are achieved within the dwellings. A 25 dB NLR is required in the noise zone from 65 to 70 dB. From 70 to 75 dB, a 30 NLR is required. Above 75 dB, residential land use is generally deemed incompatible and should be discouraged.

Sometimes, the DNL noise reduction goal in habitable rooms is supplemented by a single-event noise level criterion. This Sound Exposure Level (SEL) reflects the annoyance associated with individual flyovers because of activity interference. The SEL goal is 65 dB in general living spaces and 60 dB in bedrooms and television viewing rooms. These criteria are only applied to homes within the DNL defined noise impact area, not to homes outside the 65 dB DNL contour boundaries.

To use the SEL interior noise criteria, the outside noise exposure level is compared to the interior goal. For example, if the dwelling were between the SEL contour boundaries of 85 to 90 dB, then the required NLR to achieve 60 dB in a bedroom would be 30 dB. (The conservative upper bound of the noise zone is normally used to set NLR goals.)

### Room Variations:

The noise level of different rooms in a house depends on the absorption within the room, as well as on the noise entering from outside. Upholstered furniture, drapes, and carpeting absorb sound while hard surfaces do not. In addition, different categories of rooms vary on how predictable their sound environments are. Living rooms, for example, tend to be consistent from one house to another because they almost always have the same types of furnishings in them. Bedrooms vary because some are guest rooms with less furniture, and some have been converted to other uses. Kitchens tend to vary widely due to the use of different wall coverings, such as cabinets and appliances, or floor coverings, such as tile or carpet. These room variations act in addition to variation in exterior sound level and sound transmission through the outside wall.

## SOUND INSULATION CONCEPT

### Sound Transmission:

In order to effectively examine noise control measures for dwellings, it is helpful to understand how sound travels from the exterior to the interior of the house. This happens in one of two basic ways: through the solid structural elements and directly through the air. Consider the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall and absorbent material (insulation) in the cavity. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This surface then radiates sound into the dwelling interior. Vibration energy also bypasses the air cavity by traveling through the studs and edge connections. Openings in the dwelling, which provide air infiltration paths through windows, vents, and leaks, allow sound to travel directly to the interior. This is a very common and often overlooked source of noise intrusion.

Flanking is a similar concept and usually refers to sound passing around a wall. Examples of common flanking paths include: air ducts, open ceiling or attic plenums, continuous sidewalls and floors, and joist and crawlspaces. The three different major paths for noise transmission into a dwelling are air infiltration through gaps and cracks, secondary elements such as windows and doors, and primary building elements such as walls and the roof.

Low-frequency sound is most efficiently transmitted through solid structural elements such as walls, roof, doors, and windows. High frequencies travel best through the air gaps. Within these broad categories, different building materials have different frequency responses to sound and varying abilities to insulate against sound.

### Reducing Transmitted Sound:

The amount of sound energy transmitted through a wall, roof, or floor can be limited in several ways. First, all air infiltration gaps, openings, and possible flanking paths must be eliminated wherever possible. This is the single most important, but occasionally overlooked, step in noise reduction. This includes keeping windows and doors closed and putting baffles on open-air vents.

Some materials reflect more of the incident sound, converting less of it into vibration energy. The mass of the exterior and interior panels influences how much sound will pass through them. The more mass a structural element has the more energy it takes to set it into vibration, so adding weight to a wall or ceiling by attaching a gypsum board layer will make the assembly pass less sound. Then, absorption in the air cavity and resilient mounting of interior finish panels can further reduce the sound transmitted to the room. The primary approaches for improving sound isolation are:

1. Elimination of openings and flanking paths (when accessible).
2. Improvement of windows and doors.
3. Massive construction (build a wall 3 feet thick and 40 feet high around the whole house).
4. Isolation of panel elements through separation or resilient mounting.
5. Absorption.

### PROBLEM AREAS

Sound intrusion problems are commonly caused by:

1. Building construction components and configurations not providing sufficient sound insulation.
2. Structural elements, such as windows, doors, walls, roofs and floors chosen and combined in an unbalanced way so that some parts are much weaker sound insulators than others.
3. Unintended openings or sound-flanking paths caused by deterioration or improper installation of construction elements.

### BALANCED ACCOUSTICAL DESIGN

The most important, or controlling, sound paths must be identified in order to know how to construct or modify a dwelling to meet a specified noise criteria. The ideal sound insulation design would achieve a condition where all the important sound paths transmit the same amount of acoustical energy. This eliminates any weak links in the building's insulation envelope and is commonly referred to as a balanced acoustical design.

In most cases, after leaks and gaps are sealed, the windows are the controlling sound paths. Replacing them with acoustical windows typically does more to improve the sound insulation performance than any other architectural modifications. Once this is done, the other elements may become important in meeting specific noise reduction goals. Exterior doors often require improved sound insulation. Ceilings and walls, which face the exterior, may require modification as well, particularly in the higher DNL noise zone.

### NEW VERSUS OLD

Dwellings can vary in their sound isolation performance. Generally, air infiltration, and therefore sound infiltration, around windows and doors tends to be worse for older dwellings. Inadequate or deteriorated weather-stripping and misaligned framing usually cause this. On the other hand, most older construction techniques and materials tend to be more massive than newer lighter-weight construction. As a result, many older buildings tend to perform better with regard to sound transmission through walls, roofs, and floors than do new houses. Homeowner modifications can also degrade the dwelling's sound insulation performance. Examples include home improvements such as skylights, whole-house attic fans, through-the-wall air conditioners, and solariums. In general, it is much more efficient, and cost effective, to take acoustic performance into account when designing and building a home at the start. Remodeling an already built home is more costly and time consuming than anticipating and building for good sound insulation.

While homes, which are well insulated thermally, often perform well acoustically, thermal insulation is not always a good indicator of sound insulation. Many thermal windows, installed in new construction or added as a homeowner upgrades, provide little sound insulation when compared to walls or acoustical windows and are frequently the weak link in the building envelope. However, thermal treatments usually eliminate air infiltration and may serve to improve the acoustical performance of a dwelling. Thermal insulation batts are often useful in the wall cavities and attic spaces to absorb some sound.

The North Carolina State Building Code requires homes to meet certain R-Values for thermal performance. These requirements have changed through the years requiring higher R-Values in the more recent homes. The thickness or the density of the product normally determines the R-Value of the insulation. Older homes have less insulation and are subject to more noise infiltration. Currently, the Building Code requires R-13 in the walls, R-19 in the floors, and R-30 in the ceilings.

Most homes today are constructed using double pane windows. Although the windows perform well thermally, they usually do not perform well acoustically. The panes are separated by approximately ½ inch of air space and thin panes of glazing are used. The thin panes of glazing allow for vibration and the vibrations are transmitted through the air space to the interior glazing and into the home.

## RECOMMENDED BUILDING REQUIREMENTS

**Recommended Building Requirements for a Minimum NLR of 25 dB** Compliance with the following standards shall be deemed to meet the requirements of the compatible use districts in which an NLR 25 is specified.

### General:

- a. Brick veneer, masonry blocks, or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight, except weep holes for drainage.
- b. At the penetration of exterior walls by pipes, ducts, or conduits, the space between the wall and pipes, ducts, or conduits shall be caulked or filled with mortar.
- c. Window and/or through-the-wall ventilation units shall not be used.
- d. Through-the-wall/door mailboxes shall not be used.

### Exterior Walls:

- a. Exterior walls other than as described in this section shall have a laboratory sound transmission class rating of at least STC-39.
- b. Masonry walls having a surface weight of at least 25 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy “bridging” paint.
- c. Stud walls shall be at least 4” in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.
  - (1) Interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2” thick, installed on the studs.
  - (2) Continuous composition board, plywood, or gypsum board sheathing at least 1/2” thick shall cover the exterior side of the wall studs behind wood or metal siding. Asphalt or wood shake shingles are acceptable in lieu of siding.
  - (3) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.
  - (4) Insulation material at least 2” thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

### Windows:

- a. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-28.
- b. Glass shall be at least 3/16” thick.

- c. All operable windows shall be weather stripped and airtight when closed so as to conform to an air infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.
- d. Glass of fixed-sash windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket, or glazing tape.
- e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal Specifications: TT-S-00227, TT-S-00230, or TT-S-00153.
- f. The total area of glass in both windows and doors in sleeping spaces shall not exceed 20% of the floor area.

#### Doors:

- a. Doors, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-28.
- b. All exterior side-hinged doors shall be solid-core wood or insulated hollow metal at least 1-3/4" thick and shall be fully weather-stripped.
- c. Exterior sliding doors shall be weather stripped with an efficient airtight gasket system. The glass in the sliding doors shall be at least 3/16" thick.
- d. Glass in doors shall be sealed in an airtight non-hardening sealant, or in a soft elastomer gasket or glazing tape. The perimeter of doorframes shall be sealed airtight to the exterior wall construction.

#### Roofs:

- a. Combined roof and ceiling construction other than described in this section shall have a laboratory sound transmission class rating of at least STC-39.
- b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of closely butted 1/2" composition board, plywood, oriented strand board, or gypsum board sheathing, topped by roofing as required.
- c. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6", the roof construction shall have a surface weight of at least 25 pounds per square foot. Rafters, joists, or other framing may not be included in the surface weight calculation.
- d. Window or dome skylights shall have a Laboratory sound transmission class rating of at least STC-28.

#### Ceilings:

- a. Gypsum board or plaster ceilings at least 1/2" thick. Ceilings shall be substantially airtight, with a minimum number of penetrations.
- b. Glass fiber or mineral wool insulation at least 2" thick shall be provided above the ceiling between joists.

Floors:

Openings to any crawl spaces below the floor of the lowest occupied rooms shall not exceed 2 percent of the floor area of the occupied rooms.

Ventilation:

- a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.
- b. Gravity vent openings in attic shall not exceed code minimum in number and size.
- c. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with coated glass fiber 1" thick, and shall be at least 5 ft long with one 90 degree bend.
- d. All vent ducts connecting the interior space to the outdoors, except domestic range exhaust ducts, shall contain at least a 5 ft. length of internal sound absorbing duct lining. Each duct shall be provided with a bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room-opening cross section.
- e. Duct lining shall be coated glass fiber duct liner at least 1" thick.
- f. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination, which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.
- g. Fireplaces shall be provided with well-fitted dampers.

**Recommended Building Requirements for a Minimum NLR of 30dB** Compliance with the following standards shall be deemed to meet the requirements of the compatible use districts in which an NLR 30 is specified.

General:

- a. Brick veneer, masonry blocks, or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.
- b. At the penetration of exterior walls by pipes, ducts, or conduits, the space between the wall and pipes, ducts, or conduits shall be caulked or filled with mortar.
- c. Window and/or through-the-wall ventilation units shall not be used.
- d. Operational fireplaces shall not be used.
- e. All sleeping spaces shall be provided with either a sound absorbing ceiling or a carpeted floor.
- f. Through-the-wall/door mailboxes shall not be used.

### Exterior Walls:

- a. Exterior walls, other than as described below, shall have a laboratory sound transmission class rating of at least STC-44.
- b. Masonry walls having a surface weight of at least 40 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy “bridging” paint.
- c. Stud walls shall be at least 4” in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.
  - (1) Interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2” thick, installed on the studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer or stucco. If the exterior is siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.
  - (2) Continuous composition board, plywood or gypsum board sheathing shall cover the exterior side of the wall studs behind wood or metal siding. The sheathing and facing shall weigh at least 4 pounds per square foot.
  - (3) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.
  - (4) Insulation material at least 2” thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

### Windows:

- a. Windows, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-33.
- b. Glass of double-glazed windows shall be at least 1/8” thick. Panes of glass shall be separated by a minimum 3/4” air space.
- c. Double-glazed windows shall employ fixed sash or efficiently weather-stripped operable sash. The sash shall be rigid and weather-stripped with material that is compressed air tight when the window is closed so as to conform to an infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.
- d. Glass of fixed-sash windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket, or glazing tape.
- e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal Specifications: TT-S-00227, TT-S-00230, or TT-S-00153.
- f. The total area of glass of both windows and exterior doors in sleeping spaces shall not exceed 20 percent of the floor area.

Doors:

- a. Doors, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-33.
- b. Double door construction is required for all door openings to the exterior. Openings fitted with side-hinged doors shall have one solid-core wood or insulated hollow metal core door at least 1-3/4" thick, separated by an airspace of at least 4" from another door, which can be a storm door. Both doors shall be tightly fitted and weather-stripped.
- c. The glass of double-glazed sliding doors shall be separated by minimum 3/4" airspace. Each sliding frame shall be provided with an efficiently airtight weather stripping material.
- d. Glass of all doors shall be at least 3/16" thick. Glass of double sliding doors shall not be equal in thickness.
- e. The perimeter of doorframes shall be sealed airtight to the exterior wall construction.
- f. Glass of doors shall be set and sealed in an airtight, non-hardening sealant, or a soft elastomer gasket, or glazing tape.

Roofs:

- a. Combined roof and ceiling construction other than described in this section shall have laboratory sound transmission class rating of at least STC-44.
- b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of closely butted 1/2" composition board, plywood, oriented strand board or gypsum board sheathing topped by roofing as required.
- c. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6", the roof construction shall have a surface weight of at least 40 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculations.
- d. Window or dome skylights shall have a laboratory sound transmission class rating of at least STC-33.

Ceilings:

- a. Gypsum board or plaster ceilings at least 1/2" thick shall be provided
- b. Glass fiber or mineral wool insulation at least 2" thick shall be provided above the ceiling between joists.

Floors:

- a. The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement. All door and window openings in the fully enclosed basement shall be tightly fitted.

Ventilation:

- a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.
- b. Gravity vent openings in attic snail not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 3 ft in length containing internal sound absorbing duct lining. Each duct shall have a lined 90-degree bend in the duct such that the line of sight is interrupted from the exterior through the duct into the attic.
- c. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with coated glass fiber 1" thick, and shall be at least 5 ft long with one 90 degree bend.
- d. All vent ducts connecting the interior space to the outdoors, except domestic range exhaust ducts shall contain at least a 10 ft. length of internal sound absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room opening cross section.
- e. Duct lining shall be coated glass fiber duct.
- f. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination, which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be made of the same material and thickness as the vent duct material.
- g. Building heating units with flues or combustion air vents shall be located in a closet or room closed off from the occupied space by doors.
- h. Doors between occupied space and mechanical equipment areas shall be solid core wood or 20 gauge steel hollow metal at least 1-3/4" thick and shall be fully weather-stripped.

Recommended Building Requirements for a Minimum NLR of 35dB Compliance with the following standards shall be deemed to meet the requirements of the compatible use districts in which an NLR 35 is specified

General:

- a. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.
- b. At the penetration of exterior walls by pipes, ducts or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.
- c. Window and/or through-the-wall ventilation units shall not be used.
- d. Operational vented fireplaces shall not be used.
- e. All sleeping spaces shall be provided with either a sound absorbing ceiling or a carpeted floor.

- f. Through-the-wall/door mailboxes shall not be used.
- g. No glass or plastic skylight shall be used.

#### Exterior Walls:

- a. Exterior walls other than as described below shall have a laboratory sound transmission class rating of at least STC-49.
- b. Masonry walls having a surface weight of at least 75 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy “bridging” paint.
- c. Stud walls shall be at least 4” in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.
  - (1) Interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2” thick, installed on studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer. If the exterior is stucco or siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.
  - (2) Continuous composition board, plywood or gypsum board sheathing shall cover the exterior side of the wall studs behind wood or metal siding. The sheathing and facing shall weigh at least 4 pounds per square foot.
  - (3) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.
  - (4) Insulation material at least 3-1/2” thick shall be installed continuously through the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

#### Windows:

- a. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-38.
- b. Glass of double-glazed windows shall be at least 1/8” thick; panes of glass shall be separated by a minimum 3/4” air space and shall not be equal in thickness.
- c. Glass of windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket or glazing tape.
- d. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal Specifications: TT-S-00227, TT-S-00230, or TT-S-00153.
- e. The total area of glass of both windows and exterior doors in sleeping spaces shall not exceed 20 percent of the floor area.

#### Doors:

- a. Doors, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-38.

- b. Double door construction is required for all door openings to the exterior. The door shall be side-hinged and shall be solid-core wood or insulated hollow metal, at least 1-3/4" thick, separated by a vestibule at least 3 ft in length. Both doors shall be tightly fitted and weather-stripped.
- c. The perimeter of doorframes shall be sealed airtight to the exterior wall construction.

#### Roofs:

- a. Combined roof and ceiling construction other than described in this section and Section 3-7 shall have a laboratory sound transmission class rating of at least STC-49.
- b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of closely butted 1/2" composition board, plywood, oriented strand board or gypsum board sheathing topped by roofing as required.
- c. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6" the roof construction shall have a surface weight of at least 75 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculation.

#### Ceilings:

- a. Gypsum board or plaster ceilings at least 1/2" thick shall be provided where required by Paragraph 3-6. Ceilings shall be substantially airtight, with a minimum number of penetrations. The ceiling panels shall be mounted on resilient clips or channels. A non-hardening sealant shall be used to seal gaps between the ceiling and walls around the ceiling perimeter.
- b. Glass fiber or mineral wool insulation at least 3 1/2" thick shall be provided above the ceiling between joists.

#### Floors:

The floors of the lowest occupied rooms shall be slab on fill or below grade.

#### Ventilation:

- a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without need to open any windows, doors, or other openings to the exterior.
- b. Gravity vent openings in attic shall not exceed code minimum in number and size. The opening shall be fitted with transfer ducts at least 6 ft. in length containing internal sound absorbing duct lining. Each duct shall have a lined 90-degree bend in the duct such that there is no direct line of sight from the exterior through the duct into the attic.
- c. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1" thick coated glass fiber, and shall be at least 10 ft long with one 90 degree bend.

- d. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust ducts, shall contain at least a 10 ft length of internal sound absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room-opening cross section.
- e. Duct lining shall be coated glass fiber duct liner at least 1" thick.
- f. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination, which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.
- g. Building heating units with flues or combustion air vents shall be located in a closet or room closed off from the occupied space by doors.
- h. Doors between occupied space and mechanical equipment areas shall be solid core wood or 20 gauge steel hollow metal at least 1-3/4" thick and shall be fully weather-stripped.

### **Methods for Exterior Wall Sound Insulation in New Homes**

Typically, most wall construction consists of a 3.5-inch stud cavity with studs spaced 16 inches on center, 5/8-inch gypsum drywall on the interior, 7/16 structural sheathing on the exterior, and either siding or brick veneer as the finish on the exterior. Consider using the construction techniques below:

1. Increase the wall stud cavity to 5.5-inches, spaced 24 inches on center. The increased depth of the stud cavity will allow for the installation of R-19 insulation.
2. When considering the type of insulation material, consider using cellulose insulation material. This material is of a higher density. The method of installation is a spray method that tends to completely fill the cavity without voids.
3. Prior to the installation of insulation material in the walls, seal all penetrations through the top and bottom plates. Remember if air can enter, so can sound. Seal all penetrations through the bottom plate with caulk. Seal all penetrations through the top plate with caulking materials meeting the requirements of ASTM E-136. Sealing the penetrations is a requirement of the North Carolina State Building Code.
4. Increase the thickness of the interior wall finish from 1/2-inch to 5/8-inch gypsum wallboard.
5. Caulk around all openings through the drywall such as receptacles, switches, plumbing drains, etc.
6. Increase the thickness of the exterior sheathing material to 5/8-inch or thicker material.

7. Consider using brick veneer instead of siding material for the exterior finish. Insure at least a one-inch air space between the brick veneer and the siding.
8. If siding is to be used, avoid using vinyl siding. Choose siding with a higher density such as Hardiplank, or wood siding. Install 30-pound felt between the siding and sheathing lapped 2 inches on horizontal joints and 6 inches on vertical joints.
9. If vinyl siding is a must, install 1/4-thick fanfold insulation board between the siding and sheathing.
10. Avoid large openings or breaks in continuity in the walls, such as large windows.
11. Install bathroom vent and kitchen hood vents on the side of the home away from the flight track. Make sure that vent terminations have an automatic closure on the end. Always use metal pipe for the vent pipe.

### **Methods for Improving Attic and Ceiling Sound Insulation in New Homes**

1. Consider using energy trusses. Energy trusses allow for the installation of ceiling insulation to a full depth along the plate lines at exterior walls.
2. Install baffles on attic vents where practical.
3. Install acoustically absorptive material to a thickness equal to R-38 to the attic space to reduce reverberant sound level buildup. Apply material evenly throughout the attic space, taking care to keep it away from eave vents and openings. Consider the use of cellulose insulation. This material fills the cavity without leaving voids in the material and is of a higher density than fiberglass.
4. Install 5/8-inch gypsum board as the interior ceiling finish.
5. Caulk around all penetrations through the ceiling membrane such as light fixtures.
6. Avoid the use of “can-type — recessed light” light fixtures.
7. Avoid the use of true exposed wood beams on the ceiling. This creates a continuous path for sound through the ceiling structure.
8. Avoid the use of whole house exhaust fans in the ceiling.

### **Methods for Improving Floor Sound Insulation in New Homes**

1. Install R-30 insulation batts between the joists. The North Carolina State Building Code requires R-19.

2. Seal all penetrations through the floor assembly such as Heating and Air Conditioning supplies; exhaust ducts such as down draft exhaust from dryers and ranges, etc.
3. Install foundation vents of the swing cover awning type instead of the horizontal slider type.
4. Consider a sealed crawlspace and insulate the foundation walls, If this method is chosen, caulk between the mudsill and the foundation.

### **Methods for Improving Window Sound Insulation in New Homes**

1. The most effective method of reducing sound transmission by a window is by increasing thickness of the glass panes. Basically, thicker is better. Thicker glass tends to bend less, and therefore vibrates less when exposed to sound waves. Using 6mm glass combinations or laminated glass is the simplest, most cost effective method of reducing sound transmission.
2. When choosing windows for your new home, remember windows are generally the weakest link in sound attenuation
3. Choose windows that are double-glazed with panes at least 3/16 inch thick. Windows shall be double glazed with panes at least three/sixteenths inch (3/16") thick. Panes of glass should be separated by a minimum one-half inch (1/2") airspace, and should not be equal in thickness.
4. Double glazed windows should employ fixed sash or efficiently weather-stripped, operable sash. The sash shall be rigid and weather-stripped with material that is compressed airtight when the window is closed.
5. Glass should be sealed in an airtight manner with a non-hardening sealant or a soft elastomer gasket or gasket tape.
6. The perimeter of the window frames should be sealed airtight to the exterior wall construction with a sealant. The usual installation of windows employs stuffing the void between the window and framing with fiberglass insulation. The use of a sealant on top of the insulation material acts as an air infiltration barrier. Insulation by itself is not a good air infiltration barrier. Remember, if air can pass through, so can sound.
7. Avoid large picture windows and sliding glass doors on sides of the dwelling, which face the flight track.

### **Methods for Improving Door Sound Insulation in New Homes**

1. Double door construction should be considered for all hinged door openings to the exterior. Such doors should be side hinged and shall be solid core wood or insulated hollow metal at least one and three-fourths inch (1-3/4") thick separated by an airspace of at least three inches (3") from another door, storm door. Both doors shall be tightly fitted and weather-stripped.
2. All doors, shall be at least three-sixteenths (3/16") thick. Glass of double sliding doors shall not be of equal thickness.
3. The perimeter of doorframes shall be sealed airtight to the exterior wall construction (framing). Stuff the gap between the doorframe and the framing with insulation and seal with a non-hardening caulk. Remember, if air can pass through, so can sound.
4. Glass in doors should be sealed in an airtight non-hardening sealant or in a soft elastomer gasket or gasket tape.

### **Methods for Improving Sound Insulation in Existing Homes**

The best time to consider sound attenuation is during the construction of new homes. Retrofitting an existing home for sound attenuation can be costly. If one is considering retrofitting for sound attenuation, it is best done during a planned renovation project. As mentioned earlier in this guide, windows are generally the weakest link in sound attenuation. Some of the simpler and easiest ways to attain sound attenuation is by a combination of the following:

1. Add insulation in the attic to an overall R-Value thickness of R-38.
2. Caulk around all penetrations through the interior finishes (receptacles, light fixtures, plumbing drains, etc.).
3. Install single pane storm windows over existing single pane windows.
4. Install weather-stripping on all doors.
5. Employ any of the methods described in Methods for Improving Sound Attenuation in New Homes as the project allows.

### **Methods of Noise and Vibration Control In Residential HVAC Systems**

1. Mount the motor/fan at grade level on factory-supplied vibration isolators to minimize vibration transmitted to the house.
2. If fans or other pieces of equipment are located in the attic, use mounting bases and vibration isolators to reduce structure borne noise and vibration transmission.

3. Install flexible duct connectors to limit vibration transmitted to the ductwork or the dwelling structure.
4. Use standard sheet metal ductwork in attics and crawlspaces. Ductwork is exposed to higher levels of aircraft noise in these spaces. Do not use flexible ductwork in attic spaces since it does not have as good sound-insulating properties as standard sheet metal.
5. Supply grilles in rooms should be of the opposed-blade type and be designed for low noise.
6. A duct sound trap (muffler) should be installed just inside the fresh-air inlet opening. The sound trap will reduce any aircraft noise that passes through this opening and will eliminate the possibility of aircraft noise being transmitted via the duct path.

## Comparison of Component for Sound Attenuation

Component	Regular	Sound Attenuation
<b>Door</b>		
3/0 X 6/8 insulated embossed 6 panel exterior	\$ 175.00	\$ 175.00
<b>Windows</b> (Length X Width, United Inch = UI, Windows compared are 1 over 1 with grids)		
Up to 64 UI	\$ 214.20	\$ 222.90
64 TO 69 UI	\$ 231.20	\$ 241.10
69 TO 74 UI	\$ 248.40	\$ 259.30
74 TO 79 UI	\$ 265.60	\$ 277.40
79 TO 84 UI	\$ 282.80	\$ 295.60
84 TO 89 UI	\$ 300.20	\$ 314.00
89 TO 94 UI	\$ 317.30	\$ 332.00
94 TO 99 UI	\$ 334.50	\$ 350.30
99 TO 104 UI	\$ 352.00	\$ 368.00
Over 104 UI	\$ 3.52 per UI	\$ 3.68 per UI
<b>Insulation/Sound Batting Walls</b>		
3.5 inch stud cavity: R-13 Fiberglass Batting	\$ 0.36 psf	\$ 0.36 psf
3.5 inch stud cavity: R-13 Cellulose Sprayed	\$ 0.70	\$ 0.70 psf
5.5 inch stud cavity: R-19 Fiberglass Batting	\$ 0.39	\$ 0.39 psf
5.5 inch stud cavity: R-19 Cellulose Sprayed	\$ 0.90	\$ 0.90 psf
<b>Insulation/Sound Batting Ceilings</b>		
R-30 Fiberglass Batting	\$ 0.61 psf	\$ 0.61 psf
R-38 Fiberglass Batting	\$ 0.80 psf	\$ 0.80 psf
R-30 Fiberglass Blown	\$ 0.40 psf	\$ 0.40 psf
R-38 Fiberglass Blown	\$ 0.50 psf	\$ 0.50 psf
R-30 Cellulose Sprayed	\$ 0.32 psf	\$ 0.32 psf
R-38 Cellulose Sprayed	\$ 0.42 psf	\$ 0.42 psf
<b>Drywall</b>		
1/2 inch X 4 ft. X 12 ft.	\$ 8.98 per sheet	\$ 8.98 per sheet
5/8 inch X 4 ft. X 12 ft.	\$ 10.56 per sheet	\$ 10.56 per sheet
<b>Miscellaneous</b>		
Seal/Caulk around 3/0 X 5/0 window with non-hardening caulk assuming 3/8-inch crack		\$ 5.00 per window
Seal/Caulk around 3/0 X 6/8 doors with non-hardening caulk assuming 3/8-inch crack		\$ 6.00 per door
Insulate metal exhaust duct on exterior of duct		\$ 2.50 per foot
Values in this table are for comparison only and are not intended to be a guaranteed price quote for any product.		